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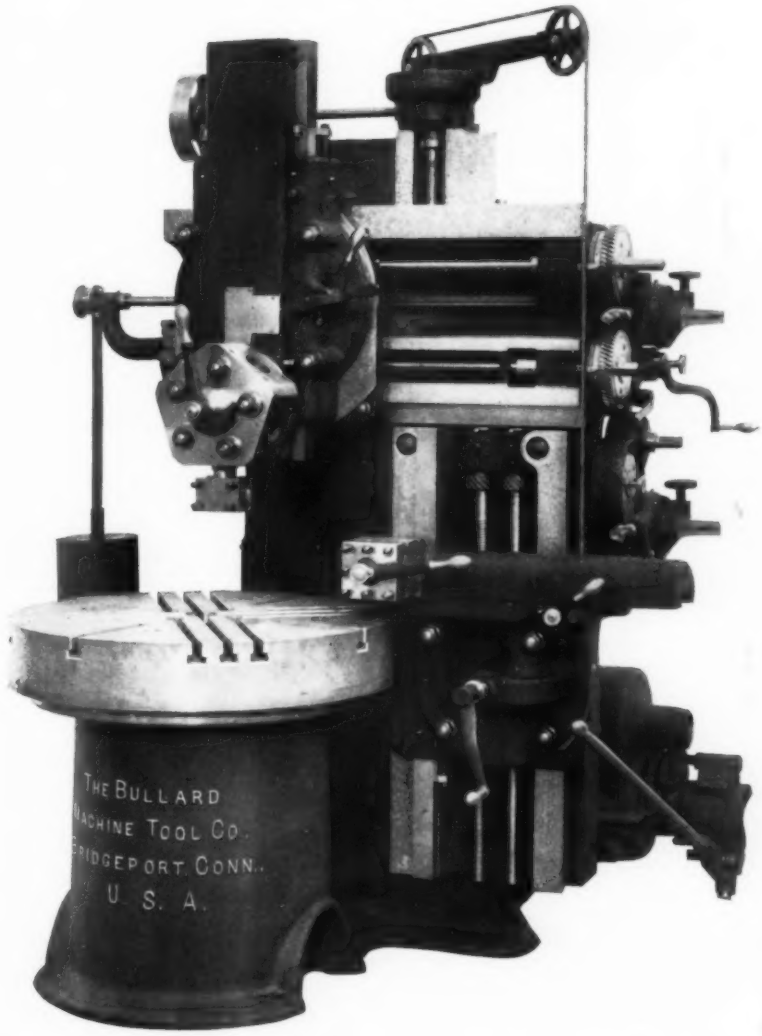

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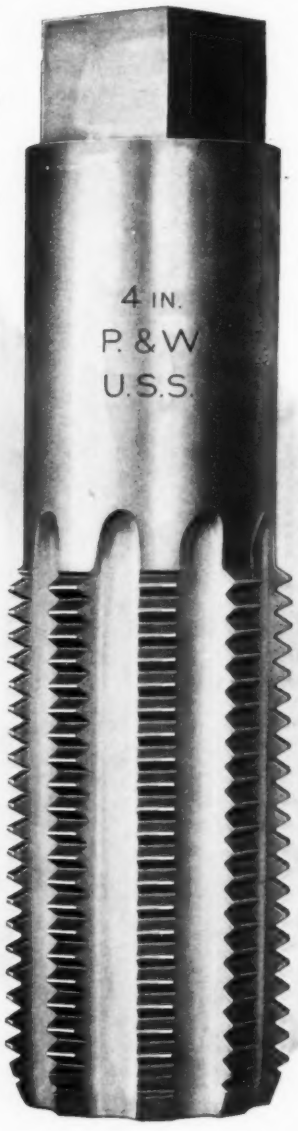

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Foundry Methods of the Landis Tool Company.

BY F. A. HALSEY.

There are few more interesting places to the mechanic than the Landis Company's foundry, where one finds original methods at every turn. The methods used in molding grinding machine beds were fully illustrated at page 194, Vol. 24, these methods being still in use substantially as described. Thru the courtesy of the company, particulars regarding additional methods are here given.

DRY-SAND MOLDS WITHOUT CROSS BARS IN THE FLASK.

The flasks used for this process are in all cases of gray iron, a section being given in the sketch, Fig. 1, which shows the drag inverted. Attention is called to the ledges *a b*, of which the former is intended to assist in preventing the sand from dropping out when the drag is lifted from the cope—for in all cases when this process is used the mold is inverted before opening it, the opening being accomplished by lifting off the drag. The ledge *b* is intended to support a series of perforated iron plates *c*, to which the pattern is secured in the manner to be described, the sand occupying the space below *c* only.

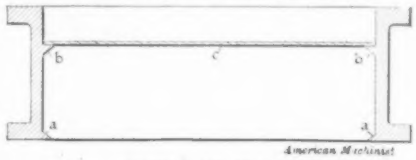


FIG. 1. SECTION OF DRAG INVERTED.

Fig. 2 shows the first operation in molding the platen of a grinder. The drag is inverted on a follow board as usual, and clamped to it as shown. The drag is entirely without crossbars, and hence is easily and completely rammed with a pneumatic foundry rammer, as shown. After being rammed, the sand is carefully scraped down, as shown in Fig. 3, to the level of ledges *b* of Fig. 1, and the perforated plates already mentioned are laid on these ledges, as shown in Fig. 4. Rods of round iron are passed thru holes in the sides of the drag, and wedges are driven under them, as shown, in order to secure the plates firmly in position.

With the plates anchored in position, it is apparent that altho the flask has no crossbars and the thickness of the sand is small, the sand is nevertheless securely held in position between the plates and the follow board, and the drag may be turned over without danger of dropping. It is therefore turned over, and the cope is placed in position and rammed up with a pneumatic rammer, as shown in Fig. 5—no follow board being used in ramming the cope, as the plates of the drag take its place. The runner box shown in this view is permanently bolted to the cope and has two gates. After ramming, the cope, which has interior ledges like the drag, is scraped down to the upper ledges as was the drag, and a set of plates like those used with the drag are placed and secured in position in the same manner. These plates in the cope again make it impossible for the sand to drop, and the entire mold is therefore inverted.

ANCHORING THE PATTERN IN THE DRAG.

In this position the drag is on top, and screws made of common wood screws with rod extensions having eyes turned at the ends welded to them, are passed thru the holes in the plates and screwed into the pattern, crossrods being passed thru the eyes and wedged in position. With these screws in position anchoring the pattern in the drag, it is obvious that the sand is securely held between the plates and the pattern and the drag may be safely lifted off. Fig. 6 shows the drag thus lifted off and partly turned over, the anchoring screws, the crossbars and wedges being clearly shown, and the cope in the foreground being bottom side up. The drag being now completely turned over, the screws are removed and the pattern is drawn. Were the cope now turned back to its proper position the sand would drop, but as it is not turned until after drying, this does not happen.

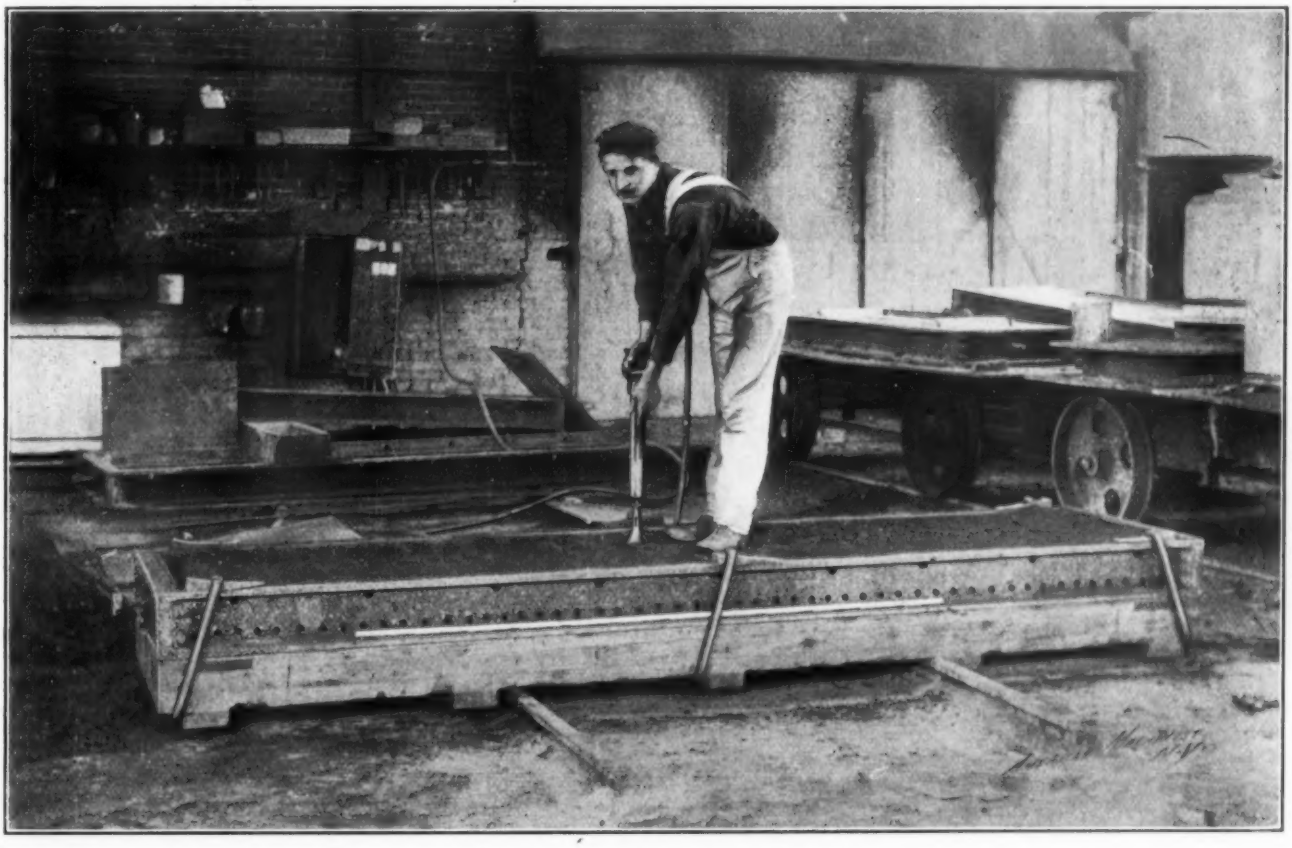


FIG. 2. RAMMING THE DRAG.

SPRAYING THE MOLD.

At this stage of the description it is necessary to describe the unique method of coating the mold with core wash, which is by an application of the principle of

the well-known pneumatic painting machine. The equipment is shown in Fig. 7, which shows a closed pot—cast from a cone pulley pattern—which has a cover for filling held in place by a yoke and screw and made air tight by a gasket. The air pipe shown has a valve above the limit of the picture and a branch of it leads to the top of the pot whereby full air pressure is maintained on the surface of the liquid—a soapstone core wash. At the bottom is an outlet for the liquid with a controlling valve and a second branch of the air pipe fitted with an elbow valve connects with the liquid outlet by a T. This T is plugged but the plug has a ⅛-inch air hole pointing directly into the entrance to the hose. In using the apparatus the air is first turned on the surface of the liquid, the liquid valve being closed. This establishes pressure on the surface of the liquid and the lower air valve being then opened, the air escaping thru the T at the bottom of the pot begins to discharge at the end of the hose, when the liquid valve is opened, the result being a fine spray which coats the mold thoroughly and with surprising rapidity. The spray reaches all rib and other recesses like those shown in the illustration of cores Fig. 8—the pot being again shown in this view, which also includes the upper air valve, and on such work the time consumed is probably not over a tenth of what would be required with a brush. The main portion of the hose is heavy air hose, but a few feet of the end are lighter and of ¾ inch diameter, as shown in Figs. 8 and 9. No nozzle is provided, the workman squeezing the outlet with his thumb, as shown in Fig. 9. Two men are required to operate the device, the second of whom is seen in the background of Fig. 9. It is found to be impossible to permanently adjust the air and liquid valves and the second workman manipulates these—as directed by the hose artist, or, if the spray is within sight, by keeping his eye on it.

A NEW FLASK CLAMP.

Fig. 10 shows the mold complete ready for pouring, this being given in order to call attention to the very satisfactory form of flask clamp used with these iron flasks. The bent rods have eccentric cast blocks at their upper ends, each block having a hole thru it for the insertion of a flat bar, the form of the blocks being shown most clearly by those on the farther side of the mold. It is clear that the blocks are held securely in the position shown but that by inserting a bar in the hole thru a block it may be easily turned past the "center" and released—the spring of the rod permitting the turning.

CHILLING SLIDE WAYS.

At page 1417, Vol. 26, Mr. Henry Hess described his method of chilling the surface of bed and other castings of machine tools which were intended to act as guiding surfaces. This process has now become a regular feature of the Landis foundry practise. Others, too, are looking into it, and it would not be surprising were it to become common in high grade machine tool work. Fig. 11 shows the manner in which the process is carried out at the Landis foundry. Resting on two angle irons will be seen a core which is to form the bottom of the mold for a grinder bed—the V in which the platen is to run being plainly seen on the near side. It is to this V, together with the mating flat way on the rear side, that this process is, for this casting, applied. By examining the near end of the V a line will be seen which marks the joint between two chill plates which are simple flat pieces of iron which are laid in the core box on the sides of the V before making the core. This line does not show in the middle and further end of the core because, as there laid on, it happens that the plate on the near side of the V overlaps the one on the far side, the joint being thus on the far side. Lying on a board near the near end of the core is a collection of chills of various sizes and for various purposes. Fig. 12 shows several castings for grinder platens to which the process has been applied, the ribs marking the joints between the chills being plainly shown.

FIG. 3. SCRAPING THE DRAG.

PRECAUTIONS AND DATA TO BE OBSERVED IN USING THE CHILLING PROCESS.

The process is not at all difficult to apply, tho, of course, certain things must be known about it to ensure success, and the following notes give details of the Landis practise. It is applied to both green and

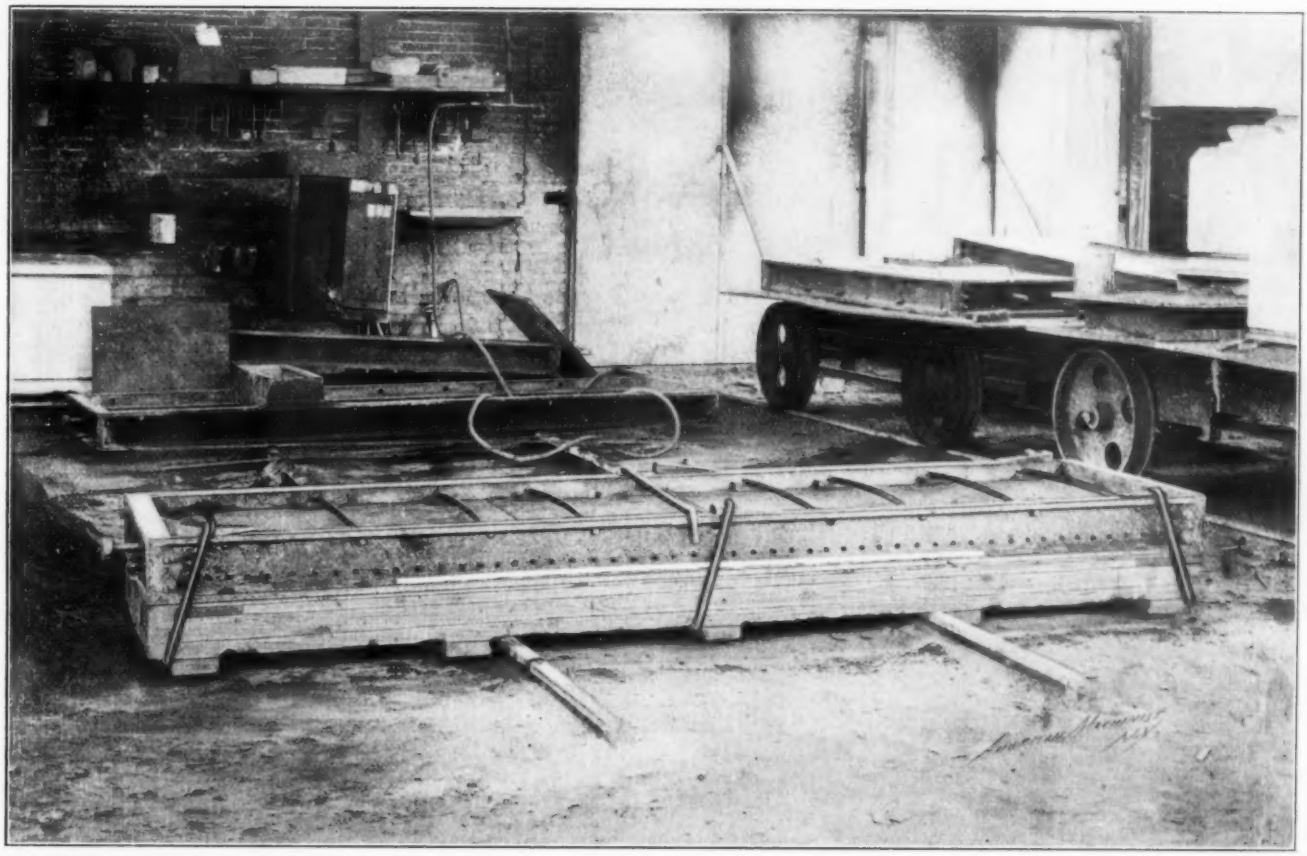


FIG. 4. DRAG WITH PLATES SECURED IN POSITION.

FIG. 5. RAMMING THE COPE.

dry sand molds and to cores, as shown in the illustration. The chili plates are preferably made in short sections, as in the examples illustrated, to prevent undue warping. With short plates, reversal as they show signs of warping brings them back, and they may be used for a long time. For soft, free-cutting iron the plates are made ⅜ inch thick for chilling castings of from 1 to 1½ inches thickness. For castings 2½ to 3 inches thick the plates are ¾ inch thick, intermediate thickness of plates being used for intermediate thicknesses of castings. For harder iron these thicknesses would be too great. In order to prevent overheating of the plates, which leads to their being fused or welded to the castings, liberal gating is necessary—the flow of iron being well distributed by the gates, so that too much of it does not flow over any one plate. The iron should be hot, should be poured rapidly and should not drop directly on the plates. Neglect of these precautions leads to spattering of the iron in the mold and to the formation of chilled shot. Another necessary precaution is to have sufficient surplus length in the flask to permit expansion of the plates. Unless sufficient room is provided for this, the line of plates buckles under the expansion and ruins the mold.

While this process is called chilling, it will be understood that it does not lead to chilling as that term is understood in connection, for instance, with car-wheel treads, because the iron used for machinery castings is not chilling iron. The effect is to densify the iron and close up the pores rather than to produce chilled surfaces. No special mixture of iron is used, mixtures which produce medium soft castings without the process being equally satisfactory with it. The machining of the surfaces is not more difficult than with ordinary castings, in fact the absence of sand offsets the increased hardness of the surfaces, so far as the effect on the tools is concerned. The scraper takes hold *much* better and keeps its edge longer, due to finer-grained iron. The use of the process by the Landis Company is a sufficient attestation of its feasibility. It marks, without doubt, a distinct advance in foundry practise. The number of defective castings is by it very much reduced. Uniformly clean and beautiful close-grained surfaces are obtained as a matter of course.

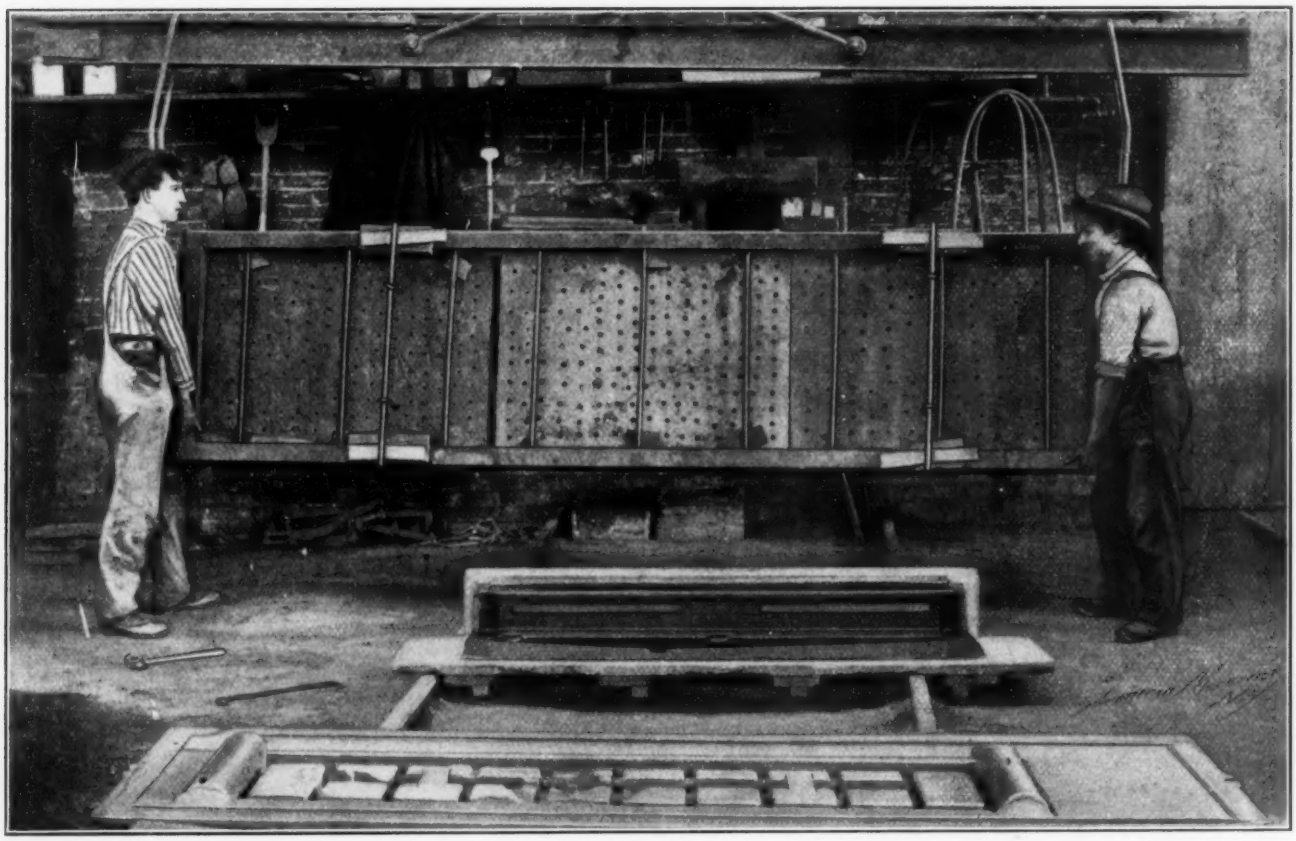


FIG. 6. THE DRAG LIFTED OFF, SHOWING ANCHORING SCREWS AND CROSSBARS.

In Iceland education is compulsory; there are no illiterates, and the standard of living is high. The foreign trade of Iceland per capita is far greater than that of any of the great commercial nations. They are fortunate in being able to offer sufficient exchangeable goods.

Many a battleship costs more than the total property—lands, buildings, and endowment—of New York University. Yet they perish in a few years either by rust or accident. The university endures forever.—*Chancellor Maccracken.*

Some Shops in the Upper Mississippi Country.

At the close of the Engineering Congress in St. Louis, last fall, an AMERICAN MACHINIST man, finding himself not far from a section of the country not previously explored by him and containing certain interesting machine shops, went first to Rock Island, where he was astonished at the magnitude and interesting character of the arsenal and of the work being done in it; this visit leading eventually to the preparation of the series of articles now being published about the arsenal, which as a manufacturing plant is unique for this country, it being pretty certain that there is no other single manufacturing establishment whose product covers anywhere near so great a range in the character of its products—from knives, forks and spoons to harness, saddles and medals and from canteens and tin cups to shoulder rifles and field-gun carriages.

DUBUQUE AND THE ADAMS COMPANY.

Following the Mississippi River, thru one of the most beautiful sections of country ever seen, Dubuque, Iowa, was reached, where the works of the Adams Company are located. This establishment is pervaded by ideas that are by no means common in manufacturing establishments, and Mr. Adams' account of how and why the union men in the foundry and elsewhere about the place are solidly on the side of the company is unusually interesting. He seemed not to be aware that there was anything particularly remarkable about it,

FIG. 7. MOLD AND CORE PAINTING MACHINE.

being based upon the general principle that by first having the intention to do the fair thing and then exercising patience and a little finesse men can often be led to do willingly what they can never in the world be driven to do.

THE BEST OF EVERYTHING.

The keynote of the place seems to be to have the very best of everything. For instance, tho far from the base of supply, nothing but Albany sand is used in the foundry, because, tho it costs about twice as much as other sand that is used in that locality, it has been found by trial to last about twice as long as the other, so that its ultimate cost or, its cost per ton of castings produced, is about the same and a further advantage results from its use in the fact that, while it is being used it enables better work to be produced at a given cost or work of a given quality at lower cost. It has been found to be the same with coke—no other than the highest grade Connellsville coke is used. Its first cost is high, but its cost per ton of iron melted is low.

A very large proportion of the total business of the Adams Company is its foundry work. Long before they became known among machinery builders they were very well known among the manufacturers of certain lines of stove fittings and stove parts, and for these their policy always has been to produce if possible a little better grade of work than any of their competitors was producing and then

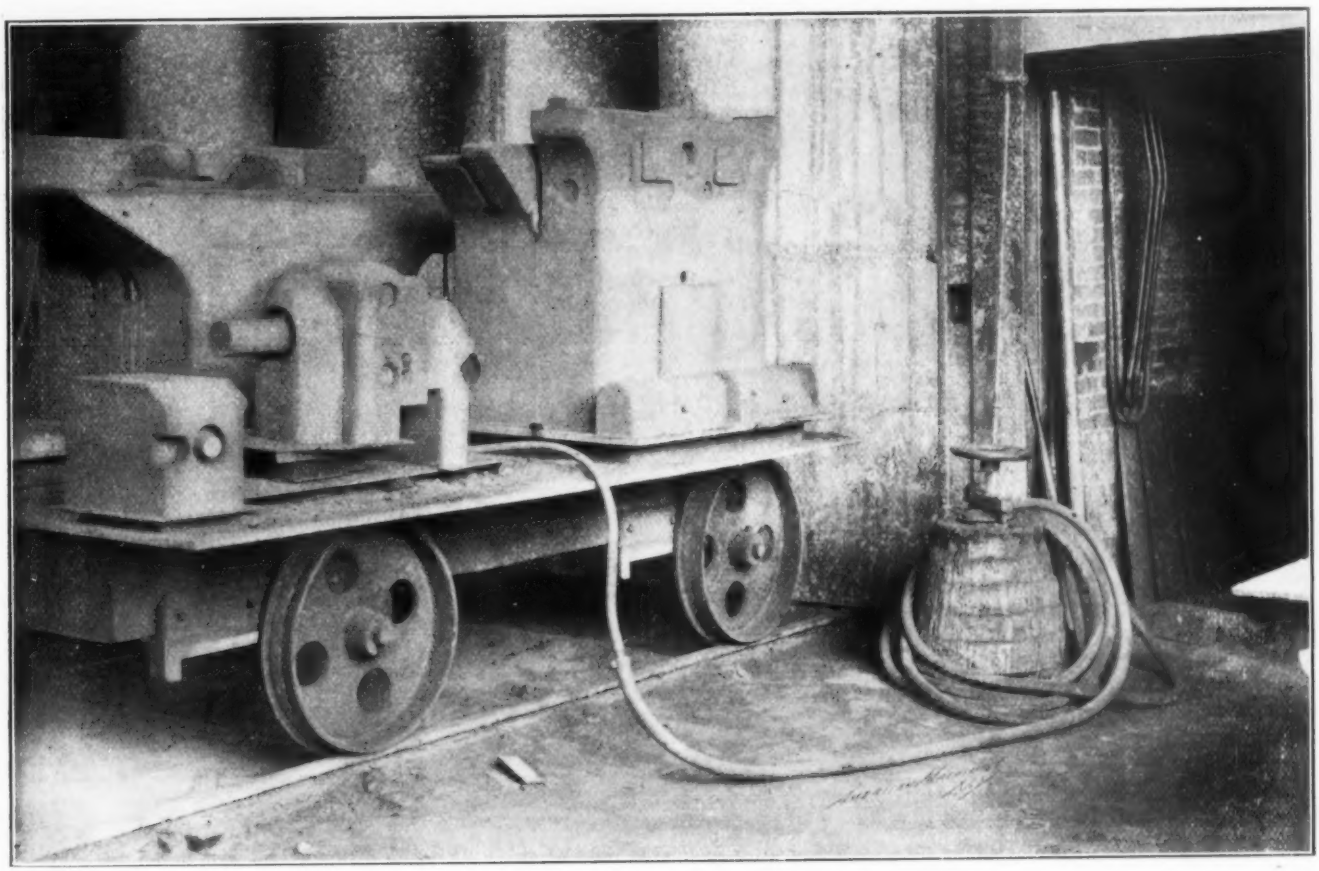


FIG. 8. ANOTHER VIEW OF PAINTING MACHINE WITH ITS WORK.

to get a higher price for it. To-day there are some sort of combines or agreements between manufacturers making certain things made by the Adams Company, and instead of selling these articles at the prices fixed by the combinations they sell them at higher figures, because they produce higher grade goods which are recognized by some dealers and users to be well worth the higher price asked for them; there being enough of such discriminating dealers and users to support a large business. All of which is somewhat refreshing to one who hears so much talk of competition having resulted in such deterioration of quality that makers of good goods can no longer compete and that it is all now simply a matter of price and discounts regardless of quality of product.

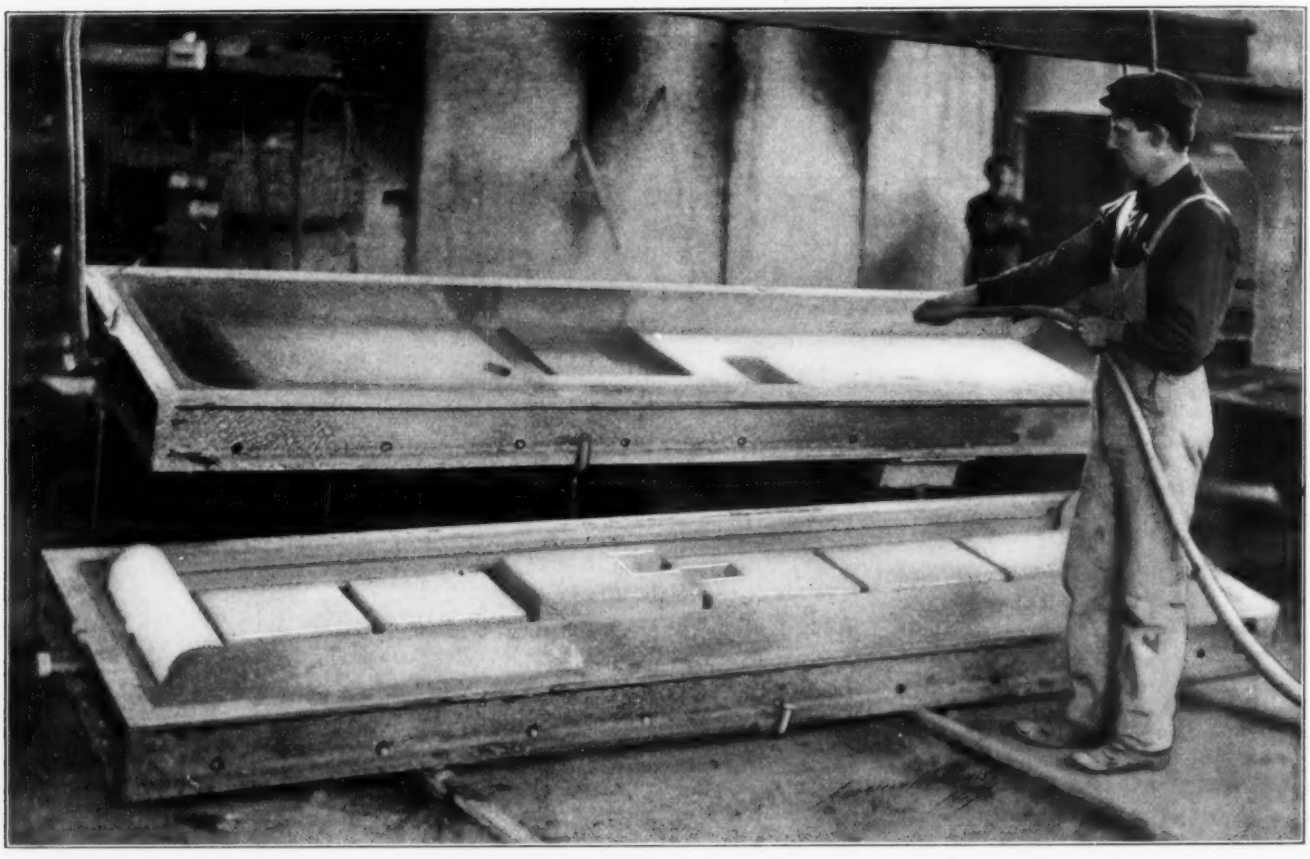


FIG. 9. SPRAYING A MOLD.

MOLDING MACHINES AND GUARANTEES.

In their own foundry they early realized the value of molding machines and made some of them. They worked well. Others saw them, wanted some like them, and they were made; always in the best possible manner and at a price worthy of the work and of the brains that had been devoted to the subject. In their own use of these machines they have found it to be best economy to use exclusively the best fixtures and appliances that can be made and to maintain them in the best possible condition. When a foundryman comes into their foundry and sees the machines at work he usually wants to know what the castings that are produced upon them cost. He is told. He is also told that no reduction is made or recommended in the wages of the men who operate them. He usually wants to know upon what terms he can buy similar machines and especially whether similar results will be guaranteed if he uses them in his own foundry. Just here is where one of the peculiarities of this establishment comes in. It will guarantee nothing. The visiting foundryman is informed that he may make as careful and thorough an examination of the machines and their work and of the conditions under which they are operated in the Adams foundry as he may wish to make. He may thus thoroughly satisfy himself as to just what the machines are there doing and how they are doing it. But he is told squarely that there are things which contribute to the successful operation of foundries, and of molding machines in foundries, which the Adams Company nor any other company can sell to a customer but which he must provide for himself or go without them. The machines might fail in another foundry to produce the results readily obtained from them here and thru no fault of the machines. A machine itself may be guaranteed, but a foundry cannot be. The character of a foundry is determined by a combination of factors none of which are under the control of the man who supplies it with molding machines.

This matter of guarantees had evidently been well studied out by Mr. Adams, he had given much thought to it and was quite willing to discuss it. As illustrating his position, he said that a few days before he had sold a horse to a liveryman in town. He would let the man ride behind the horse all he wanted to in order to find out how he went, but Mr. Adams himself did the driving, nor would he permit the prospective purchaser nor anyone representing him to hold the reins over the horse. The horse was nevertheless sold at Mr. Adams' price, and said he: "If the liveryman had driven him before purchasing, the horse might, for some reason not at all the fault of the horse, have failed to suit him. In that case he would have not only declined to buy, but, this being a small town and the liveryman well known here among those who are interested in horses, his failing to like the horse on trial would have damaged the reputation of the horse and perhaps have prevented me from getting a fair price for him. As it is, the man, having abundant opportunity for seeing what the horse did in my hands, bought him; and, the horse then being his own, he was bound to make him do at least as well and has had no trouble in doing so. He is now saying to people around town that he bought the horse for $50 less than he is worth. Perhaps he did, but at any rate he paid the price I asked; I am satisfied and evidently he is too."

A NOVEL AUTOMOBILE.

For some time past this firm has been developing an automobile, the engine of which we illustrated and described at page

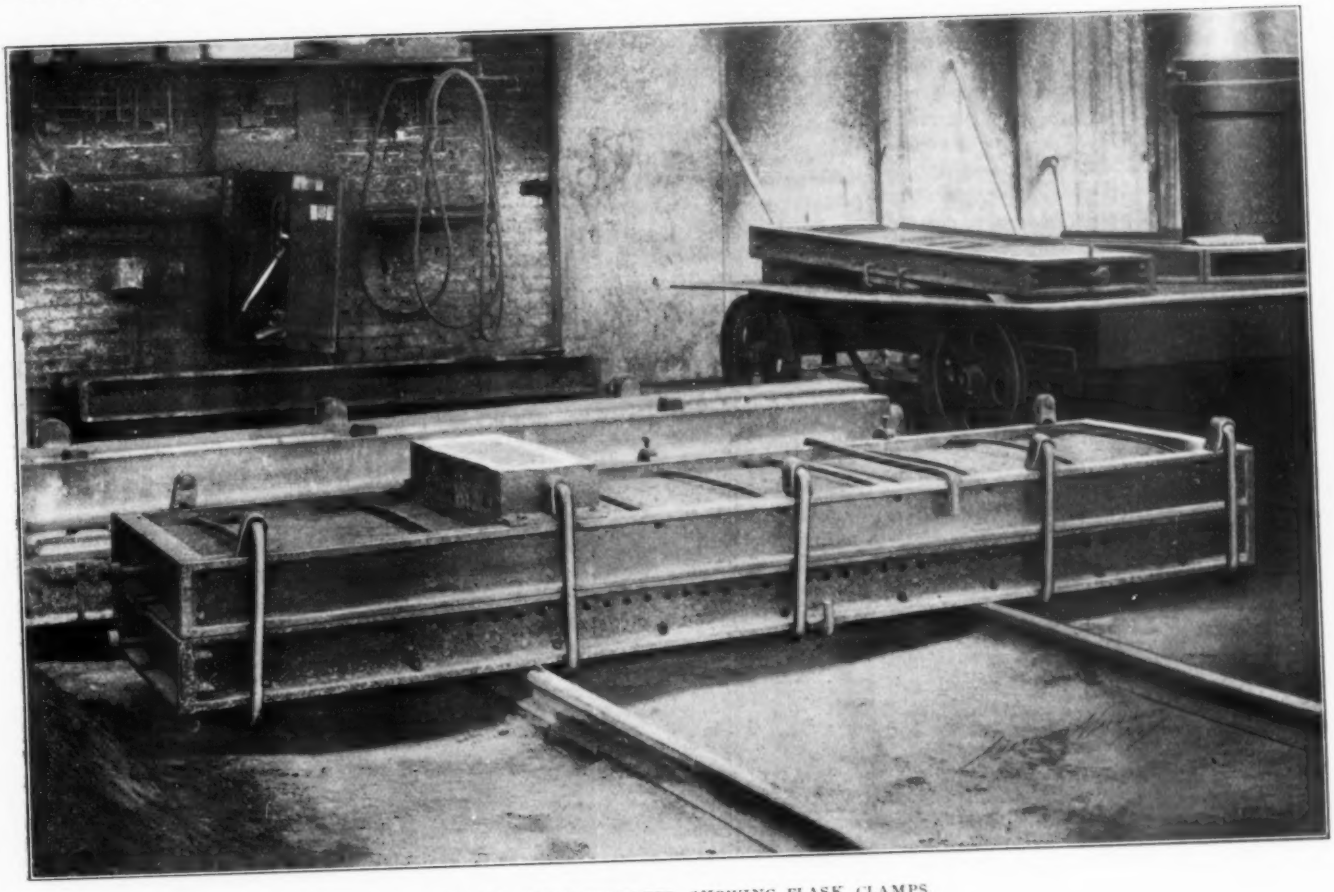


FIG. 10. MOLD COMPLETE, SHOWING FLASK CLAMPS.

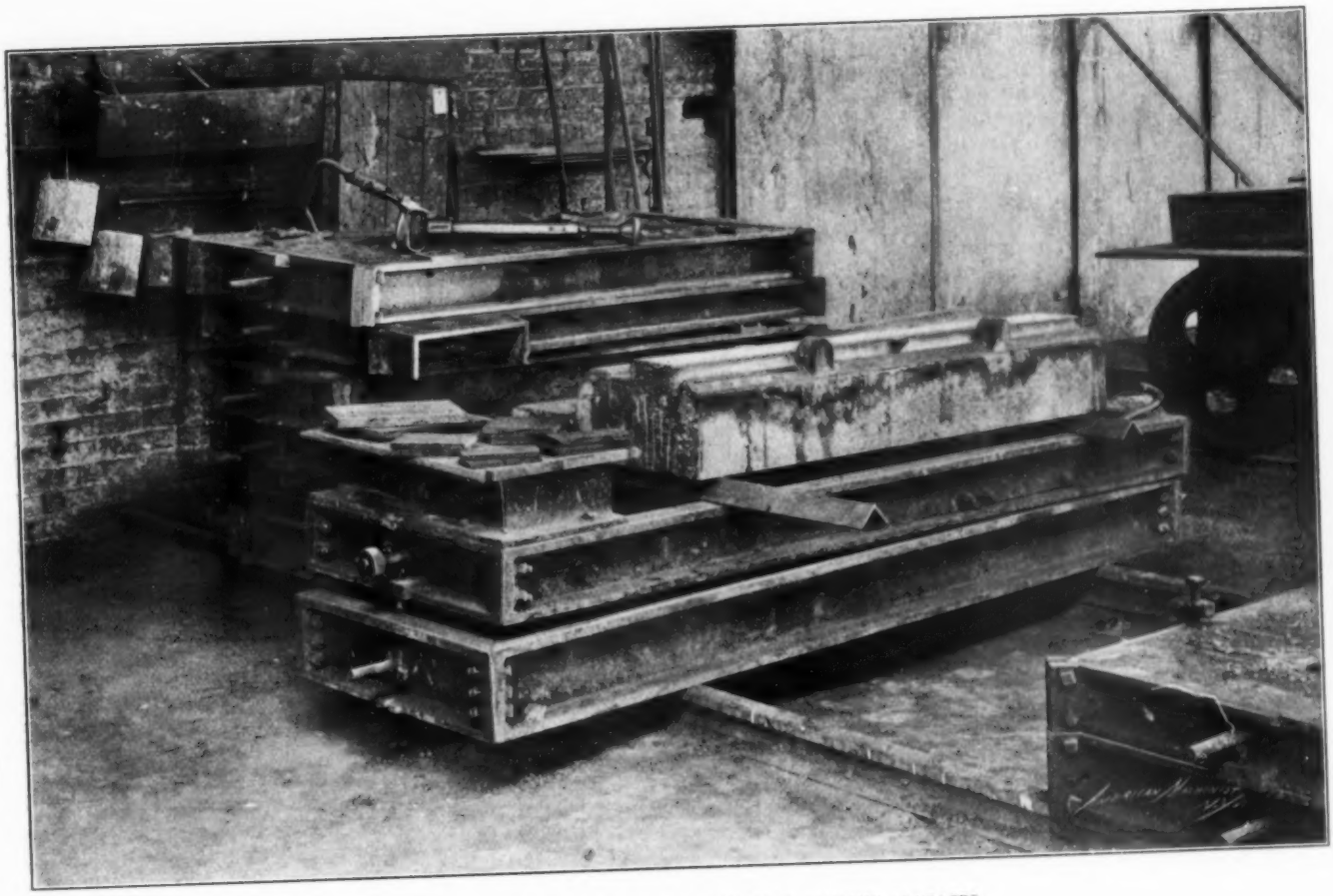


FIG. 11. CORE WITH CHILLS FOR CHILLING GUIDING SURFACES.

1448, Vol. 27. This engine, as will be recalled by those who were interested in it, is so entirely different from the ones usually found in automobiles that it will almost certainly be very difficult to convince some of the prospective auto buyers that it will do the same things that are done by the others in much the same way and that, in addition, it has some notable advantages peculiar to itself. They have built a number of them and have put them to very severe tests in the hilly and difficult country about Dubuque. They know perfectly well what they will do. They are putting the very best of everything into their construction and probably can as well afford to guarantee as can any other builder, and can certainly better afford it than a good many others can. But it is doubtful if they will give any guarantee at all. Mr. Adams did not say positively that he would not, but said he doubted if they would, at the same time evidently realizing that it would be a pretty bold stand to take and one that would be very apt to be misinterpreted by very many and also made use of by competitors. Perhaps they will not refuse to guarantee, but if they do it will be interesting to know how the plan works out. One thing I am certain of and that is that a light runabout car with Mr. Farwell, the superintendent of the shops and inventor of the car, driving, and with a 190-pound man beside him, mounts the steep and long hills that compose the surface of the country about Dubuque with very little apparent effort, at high speed and in a manner that is in every way entirely satisfactory. It will be remembered that the engine of this car has three cylinders which rotate in a horizontal plane about a fixed crank which is set eccentric to the center of rotation of the cylinders by one-half the stroke of the pistons. Thus the cylinders perform the function of a flywheel and make any other unnecessary, while at the same time they are so formed and placed as to act as their own fans to keep cylinder temperatures down.

It is expected, too, that there will prove to be an appreciable difference in the steering of these cars, owing to the fact that the gyroscopic action of the heavier and more rapidly rotating parts is in a plane which is at right angles to the plane of this action in a car having a flywheel upon a horizontal shaft so that every change of direction of the car necessitates a corresponding change in the plane of rotation of the wheel. It will be perceived that the Farwell-Adams car can turn a complete circle or change its direction as much as one pleases, without any alteration of the plane of rotation of the tri-cylinder flywheel, and consequently without any gyroscopic resistance to turning.

Mr. Farwell is best known to our readers as the inventor of the Farwell milling attachment for planers which is made here and is very extensively used in their own practise.

PLACER MINING IN A FOUNDRY YARD.

Out in the yard near the foundry is an arrangement which reminds one of the South African diamond mining exhibit which was shown at the Chicago Exhibition in 1893. This one is not used for washing out diamonds, however, but more prosaic gray iron and coke. Near the structure was a pile of debris—a year's accumulation from the foundry and composed of what was left in the cupola at the end of the melts, droppings of iron from ladles, pieces of coke, sand and dirt—a most unpromising pile of stuff. But men were shoveling it into the machine referred to which carried it by an endless belt arrangement to the top, from whence, as it descended by gravity, it was variously washed, screened and otherwise manipulated until, at the bottom, there emerged iron (mostly shot iron) and small pieces of coke which were separate from each other and from all things else and were recovered for subsequent use. The iron is sold, as it is found not advisable to use anything in the Adams foundry cupolas except a mixture of one-third No. 1 and two-thirds No. 3 Southern iron. The coke recovered alone pays the wages of the men who operate the apparatus. Of course it does not go all the time; they wait until there is about a year's accumulation and then in a few weeks they run this thru, and clean it up.

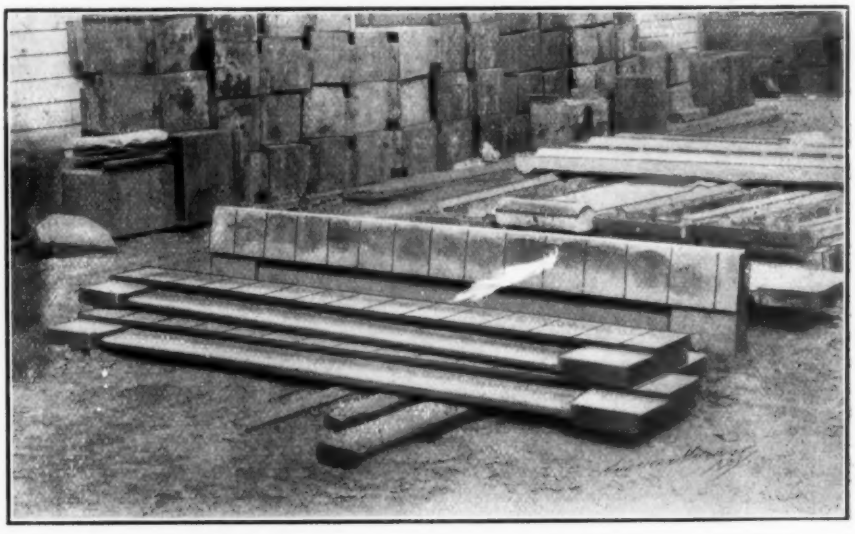


FIG. 12. CASTINGS TO WHICH THE CHILLING PROCESS HAS BEEN APPLIED.

W. F. & JOHN BARNES, ROCKFORD.

There is apt to be in the minds of those who have never visited this section of the country some confusion between Rock Island and Rockford, both being Illinois towns and with names which it requires a little attention to clearly differentiate. There are people who think that W. F. & John Barnes or Ingersoll have only to go across the street perhaps to reach the arsenal, whereas the fact is that they have to go more nearly across the State, the distance being something like 100 miles. Like most small boys who have wheels in their heads, I used to see in various papers the advertisements of W. F. & John Barnes, and wonder how long it would be before I could manage in some way to acquire one or more of their foot-power machines which would do all the things with wood and iron which I was continually wanting to do. For a long time these people built no other than foot-power machinery and tools, but now, so far as one might judge from the looks of their shop and the work going thru it, power-driven tools are much the more important part of their work.

I found them experimenting with high-speed steels, tho in some respects they had gone much past the experimental stage and were planing gray iron regularly at 50 feet per minute, all their planers either having been already changed or about to be changed to be driven at this speed and one other.

One of the marvels of the age is the price at which this firm and some others can sell drill presses. It is not so difficult to understand it after going thru the shops and noting the tools they have for making them. Usually where a shop is provided with drill jigs for drilling the holes in such a piece as the frame of a drill press,—jigs which will locate one hole at a time and leave the larger holes to be bored by separate operations, we think it is pretty well equipped. They have for a long time been far beyond that point here for they have machines—one or more for each size driller frame—which machines have separate spindles, correctly located, driven and fed for each hole in the frame; so that all the holes are drilled simultaneously, while a boring bar is boring the larger and more important holes. They even make some milling cuts at the same time so that the frame, which goes into the machine practically nothing more than a casting, comes out pretty nearly a finished drill-press frame and this is all done at very little above the cost of performing upon it that

operation which would in any event require the longest time to complete. It is difficult to say whether such machines and the other features which naturally accompany them are the cause or the effect of the large business of the company in drill presses, but in any event they are the accompaniments or the complements of each other.

GEARS AND RACKS.

In the matter of gears I noticed that for every pair of standard gear wheels used on their regular machines they have a testing plate which consists of two studs set at the center distance for the two gears that are to run together. These studs are not adjustable but their center to center distances are fixed and unchangeable. Fitted to the two studs are two gears which run together exactly as it is desired that the two corresponding gears shall run in the finished machine. When a lot of either of these gears composing any pair is being cut, they are tried in the tester thus made especially for them; that is to say the model wheel representing the lot being made is removed from its stud and the new gears are seen to match the other model gear of the pair properly. If when a lot of the other gears of the pair are being made it is seen that they run properly with the first mentioned model gear it is evident that all of them will run properly together and that this is a practical application of the old geometrical rule that things which are equal to the same thing are equal to each other.

For drill presses and lathes they make a great many racks in these shops and I saw them making these in a way that was new to me. There were gray iron plates about 13" square and the proper thickness. These were first held in a chuck in the lathe and faced off for the roughing cut; this having been found more economical than to plane them. They were cut in a machine of the planer type, using a gang of rotary cutters and were then cut into racks by slitting cutters.

It will be remembered that some years ago we illustrated and described in these columns a machine devised and used in these shops for cutting bevel gears and in which the usual rotary cutters are used for the purpose but instead of going once around the blank with a setting proper for one side of the tooth space angle and then changing to the angle for the other side and going around again, it is all accomplished at once by giving the indexing head an oscillating motion in a horizontal plane with the small end of the tooth space being cut as the center of the motion. This motion is imparted to the head by means of a cam and is just sufficient to give the increased width of space required at the larger end of the teeth. When I was there they were using this device in making a certain mortising chisel for one of their wood-working machines. This chisel requires a milling cut of uniform depth but of gradually increasing width toward the shank of the chisel and the device referred to gives this cut very neatly at one operation.

POWER TRANSMISSION BY SASH CORDS.

It may be remembered that several years ago there was an article published in these columns giving an account of the peculiar system of power transmission in use in this shop. It consists of ordinary window or sash cords which are used in grooved pulleys and, the required number of these being placed side by side to transmit the required amount of power, they go on transmitting it and there seems to be no trouble from them whatsoever. Of course they run at high speed and tho when one looks at them it seems almost impossible to believe that they can carry the power they do it year after year and Mr. Barnes speaks in the most enthusiastic terms of the manner in which they do it. When the article referred to was written they had been in use for some years. They have now added several years to their record of entirely satisfactory service, and there seems no reason to suppose that they will not go on indefinitely.

AN ELEVATOR GUARD.

Going up and down on the elevators in this shop, I noticed in each door or other opening that we passed a strip of wood about 7/8 inch square which was fastened across the opening a foot or perhaps a little more from the top and flush with the walls so that the floor of the elevator car passed close to it; in fact just as close to it as it did to the wall at the top of the opening. These strips appeared to have no particular function to perform and I enquired about them. Then I found that they performed the same office as is performed by the dangling cords which are suspended from a cross-beam over a railroad track just before a bridge is reached and which by striking a brakeman standing on top of a freight car notify him that it is time to look out for himself. So with these strips; in passing an opening in the wall, if a passenger lets his foot project over the edge of the car floor far enough to be caught by the brick wall at the top of the opening it will first encounter this strip of wood which, while not strong enough to hurt him, or to hold his foot, is strong enough to pinch him sufficiently hard to make him realize that it is time to get his foot back out of the way; and, even if a greenhorn who has never seen such strips before and does not know what they are for, gets caught by one of them, he will instinctively pull his foot away and thus save himself from injury. The sticks get broken often—some in the performance of the duty they are provided to do and others by various things that are being carried thru the openings. It is a part of the duty of one man to see that broken sticks are immediately replaced.

BALL HINGES ON FLASKS.

When hinges of the ordinary kinds are placed in pairs we all know that their axes must be in line in order to have them work and it is not always easy to have them so in the case of irregularly shaped pieces. In the foundry here, they use flasks of a peculiar shape, roughly following the general outline of the frames of the drill presses, that are cast in them. The two parts of this flask are hinged together and instead of using hinges with cylindrical axes, which must be carefully lined with each other, and one of which would in this case require to be blocked up to a considerable distance from the side of the flask they use hinges with ball and socket joints. Two such hinges are always necessarily in line with each other and will work properly, no matter how they may be placed; the axis of rotation of the cope simply passes thru the axis of both the balls and that is all there is to it. As one of the hinges is near one end of the flask, and the other hinge near the other end, they insure a perfect match of the mold when closed and they are so arranged that when the cope is raised on the hinges, it can then be lifted off entirely if it is desired to do so.

THE INGERSOLL SHOPS.

At the Ingersoll Milling machine shop they were busy on some machines of the type with which the name of Ingersoll has become identified, much larger than any they had previously built, some of the largest then in hand being designed for contractors who were to use them in furnishing the flanges of the tunnel plates of the new Pennsylvania railroad tunnel under the North River at New York. For this purpose they were being equipped with special heads carrying spindles to be set at the required angles for the radial joints, but otherwise they were the regular machines, adapted to be used for such general work as might come to the shops of their owner. A new addition to the Ingersoll shops was just about completed—built of concrete and in which there had been a problem as to how to deal in a satisfactory manner with runways for an overhead traveling crane designed to carry heavy loads.

AN OLD LATHE WITH A MODERN IDEA IN IT.

In looking about this shop with the superintendent, Mr. Smith, we came upon an old lathe which interested me very much. Seeing that it was evidently much older than the Ingersoll establishment, even going back to the time when the latter was located in Cleveland from whence it went to Rockford, I inquired where they had found the lathe and was told that it had been gotten once upon a time in Chicago, from a dealer, when they needed something that simply had centers and that would give rotary motion to work while it was being polished. The lathe had no name plate upon it nor any mark by which its builder might have been identified, but there were certain earmarks about it that indicated that it had been made in Worcester. It dated back to a period when it was more or less the fashion to make the

foot stock to rest upon four legs, one at each corner, the apron was semi-circular in shape, and the cone pulley was of wood. But the most interesting feature of this old lathe was the fact that in the arrangement of the shears, the very most modern ideas as advocated by Prof. Sweet had been incorporated. There was but one guiding shear for the carriage and that one was in front, the rear one being flat and the carriage resting on top of it only, in the most approved fashion. The front shear was ridiculously small and narrow compared to present-day standards and all over the lathe were the signs of a bygone age in machine tool construction, but along with all the rest was this most modern of features—so modern in fact that it is not even yet generally adopted, and in at least one instance that I know of, a builder who had become convinced by his own reasoning and by experience in his own shop that this was the right construction and undertook to introduce it in the lathes which he builds and of which he makes a specialty, was compelled to give it up for purely commercial reasons—it cost him too much to do the educational work necessary to convince his customers that it was right and not simply a device to skimp the work on the lathe and save a little in the cost of its construction at the expense of the buyer.

There are many indications, however, that the principle involved here is gaining recognition and that it is going to be used quite generally some day and when it is, it will be due, not to the sporadic cases in which it has been used here and there from time to time, but to the full recognition of its merits and the persistent presentation of them which we owe to Prof. Sweet.

B. F. BARNES COMPANY.

The B. F. Barnes Company of Rockford, is an offshoot of the other Barnes establishment, such as we so frequently see here in America where a man whose ability has contributed in an important degree to the success of an old establishment comes sooner or later to the point where for one reason or another he prefers to have his own shop and run it in his own way. B. F. Barnes, who is one of the original Barnes Brothers, and was for many years, superintendent of the W. F. & John Barnes shops, is at the head of the newer establishment, which has built very modern shops in another quarter of the town where they are building a very similar line of work, tho I believe few, if any foot power machines or wood working machines, their product being mostly, if not exclusively, machine tools to be driven by power.

I found Mr. Barnes himself over a drawing board, studying out the lines of a new lathe which he said he did not intend should possess any very new or radical features, but would be designed within conservative and well tried bounds, and so as to be made at a price that would sell in competition with other similar lathes, at a profit—the sort of a problem which, after all, a great many men bending over drawing boards are at work upon and the solution of which keeps many a wheel turning all over the land.

DRILL-PRESS MANUFACTURING.

Just at the time most of the work in the shops seemed to be drill presses and the methods of making them were, naturally, very similar to those pursued in the other shop, with such improvements in the special fixtures and machines as would naturally suggest themselves to the man building them after having had years of experience with the others. In the making of cone pulleys particularly, both in the foundry work and in the machine shop, the methods followed were exceedingly efficient. In the machine shop I saw a cone pulley having five steps ranging from 2 to 5 inches in diameter and 1⅜ inch face being bored, reamed and turned complete in fifteen minutes and the work was not being done in a lathe or turret machine at all but in an ordinary drill press of standard pattern, built in the works and fitted with special fixtures for the job. And the work was well done, the fixture in fact determining the relation of the axis of the pulley to the various tools at all times rather than the drill press spindle which latter was depended upon only to give the necessary rotary motion and the feed.

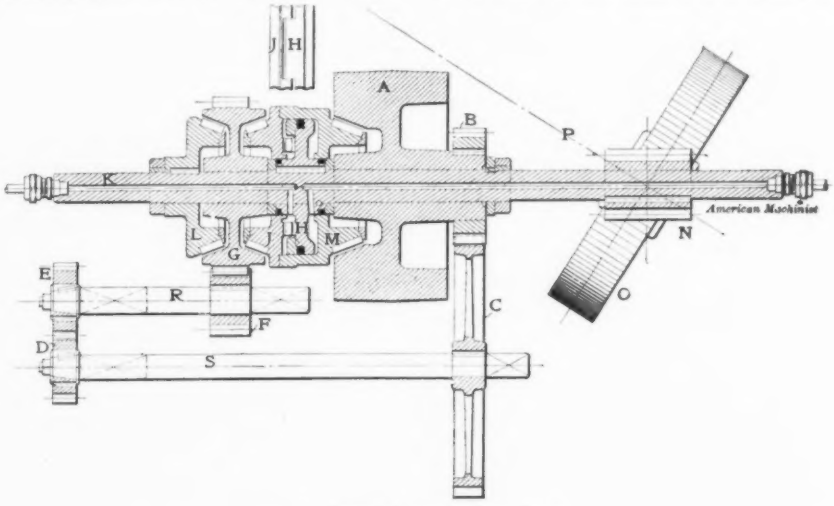


FIG. 2. SECTION OF DRIVING GEAR.

CUTTING BEVEL GEARS ON A DRILL PRESS.

Another most remarkable development of the drill press was in cutting gears. It looks queer to see a drill press cutting a bevel gear, but drill presses are to be seen doing that in this shop and it seems to have come about in the most natural manner. They were building a small drill press for manufacturing purposes which had not only an automatic feed but an automatic release of the feed when the desired depth of hole had been reached and an automatic return of the spindle to its highest position ready for the next hole. All the boy has to do is to put in the work and trip a lever when the spindle descends rapidly to near the work and the regular feed is thrown in again automatically. All that Mr. Barnes did was to place upon the table of such a drill press a proper fixture for holding a gear blank at any required angle. To the same arbor that held the blank he attached an index-plate and connected a rotating and stop motion for this plate to the mechanism which returned the spindle after the cut. He also, of course put a spiral gear arrangement on the spindle to bring the axis of the gear cutter horizontal and the arbor holding the gear cutter does not depend upon the drill press spindle for its support and accurate positioning with respect to the blank, but there is a slide provided for this on the fixture so that the cutter arbor and the blank-holding arbor are very closely tied together. All the boy now needs to do is to go along in front of a row of such drill presses and, with a knock of his hand, release a lever and a new cut is started and it makes little difference to him whether that cut is one which produces a bevel-gear tooth or whether it produces a simple drilled hole.

Undoubtedly nearly every mechanic who should be asked about cutting bevel gears on a drill press would treat the proposal with lofty scorn as the impossible notion of a man entirely ignorant of the requirements of the job. But it is done here and done well, the secret of it being of course that the fixture itself holds the blank and guides the cutter; the drill press furnishing only the rotary and the feed motions and the strains that are carried by the frame of the machine cannot in any way affect the accuracy of the job. It is apt to give a man a shock to see such a thing as this, but the shock is rather a pleasant one after the first moment—and beneficial too.

F. J. M.

The Waterman fountain pen has just come of age. In the first year of its existence the number of sales was 200, last year it was 750,000.

A New Variable Speed Planer With Air-Actuated Friction Clutches.

The accompanying illustrations show a variable-speed planer by William Sellers & Co., of Philadelphia, which is the culmination of several years of work in the development of such machines. The planer is 8x8x20 feet in size, and has a cutting speed which is variable between 15 and 45 feet per minute, the return speed being constant at 80 feet per minute.

DRIVING MECHANISM.

The driving and reversing mechanism is shown diagrammatically in Fig. 2. *P* represents the shaft which carries the spiral pinion driving the table. On its outer end is mounted a spur wheel *O*, which is driven by the spiral pinion *N* on the pulley shaft. The driving pulley *A* runs loose on the pulley shaft *K*. It runs continuously and in the same direction while the planer is in operation. On its hub is a pinion *B* driving thru a reducing train of gears *C*, *D*, *E* and *F*, to a gear *G* mounted loosely on the pulley shaft. It is evident that the wheel *G* will run in the opposite direction to the pulley *A*, and at a reduced speed depending upon the ratio of the gears in the train. The pulley *A* is turned on one side to form the receiving half of a conical friction clutch, and the gear *G* is turned on both sides in a similar manner. *J* and *M* are two conical entering elements of these clutches bolted together and forming an air-tight cylinder free to move back and forth on the disk *H*, which is keyed and pinned to the shaft *K* and forms a piston in the cylinder. In order to compel the shaft to rotate with the friction clutch the head of the cylinder *J* is provided with notches into which project teeth on the surface of the piston *H*, forming a jaw clutch as shown in the detail, and permitting end movement, while they compel the parts to rotate together. Air admitted to one end of the cylinder thru the center of the shaft *K*, between the parts *H* and *M*, will press the friction cone *M* against the pulley so as to cause the clutch to rotate with the pulley. This movement will be transmitted thru the piston *H* by the clutch teeth, and cause the shaft to rotate in the same direction, which produces a return movement of the table. Admitting air to the opposite end of the shaft will cause the clutch *J* to engage with the wheel *G* and to force it against the stationary clutch *L*, which is keyed to the shaft, and thus during the cutting stroke make the gear *G* drive the shaft thru both of the clutches, one on either side, at a speed which may be varied by changing the gears *E* and *D*. These are mounted on split bushings with conical holes, which permit the gears to be shifted with the minimum amount of trouble.

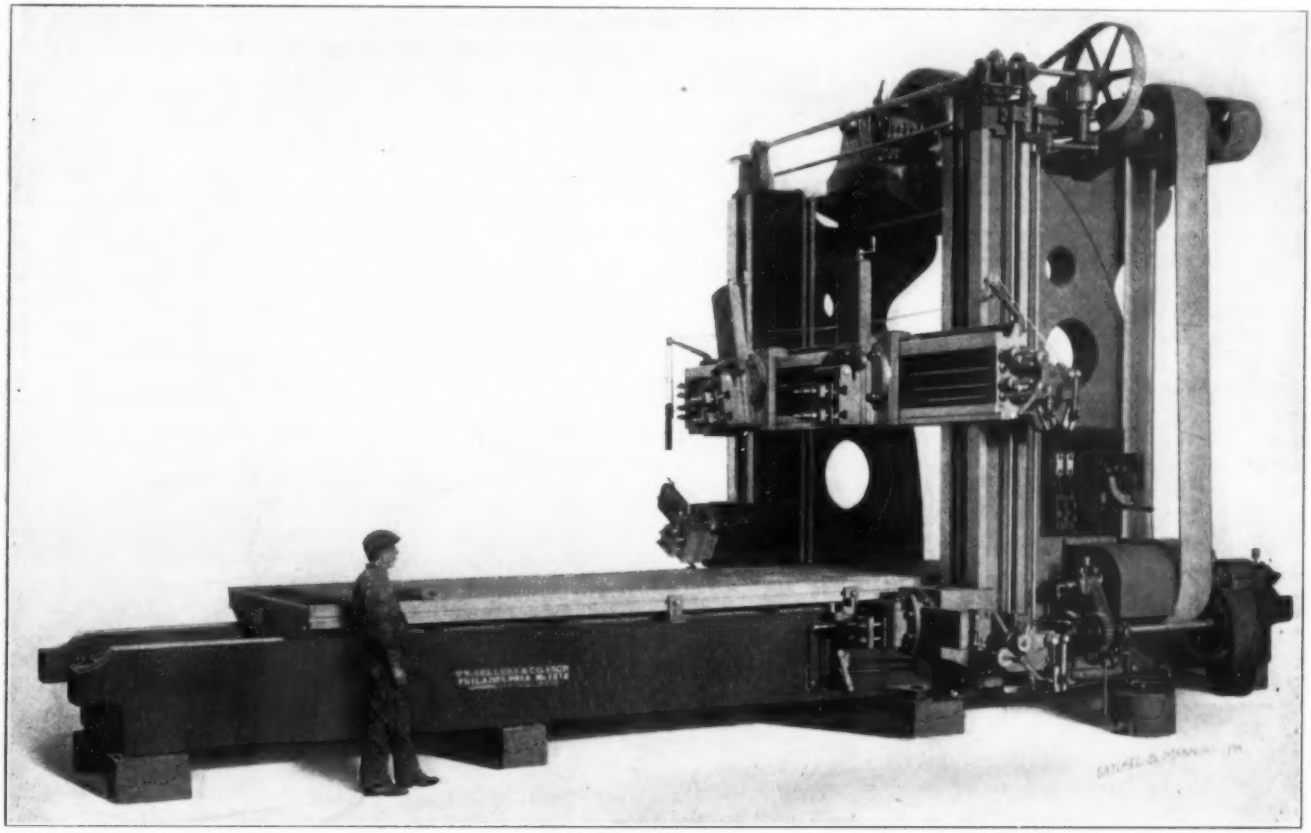


FIG. I. VARIABLE SPEED PLANER.

OPERATING GEAR AND FEED MECHANISM.

In the operation of the planer the table stops move an air valve which admits compressed air alternately to the opposite ends of the cylinder, and by regulating the velocity of the admission the speed of reverse can be nicely gaged. It is so adjusted that the table is brought to rest promptly and started up in the opposite direction without shock. There is no reversal of high-speed pulleys and the flywheel action of the parts whose motion is reversed, owing to their relatively small size, is reduced to the minimum. The pulley *A* may be driven thru a countershaft in the ordinary manner, or from a motor as in the present instance, where the 50 horse-power motor is mounted on a gray-iron platform carried on brackets from the housings, and which serves as a cross-girt between them, all as shown in Fig. 1. The motor drives by a horizontal belt to a countershaft, which in turn drives the pulley shaft at the base of the housing. A separate belt is used to actuate the tool-lifting gear and drive the feed motion. The latter is accomplished thru a positive motion clutch, which is stopped and started at each reverse of the table. The movement of the table dogs not only actuates the air valve, but it trips the escapement train in the feed motion, and allows it to make half a revolution. This gives a half turn to each of the crank disks on the end of the cross-rail transmitted from the clutch thru a square shaft on the side of the housing, by bevels to a horizontal shaft driving a similar square shaft on the left-hand housing. Each of these disks, having a half turn at each reverse, the amount of feed is determined by the position of the crank. The work done by the dogs, it will be seen, is of the lightest character, and the shifting by hand is also easily accomplished.

A novel feature of the side heads is that they are lifted by the same screws which carry the cross-rail. These screws are stationary under ordinary circumstances, and the heads are raised and lowered by rotating the nuts.

It is found in practise that this form of clutch releases and engages with great regularity and very promptly, so that the stroke of the planer is remarkably uniform, the reverse taking place at the same point, the overrun at the beginning of the stroke being only sufficient to allow the feed to act.

STRUCTURAL FEATURES.

Another novel feature about this planer is the manner in which the crossrail is secured to the uprights. The back between the uprights is extended in a rectangular form, with two vertical surfaces fitted with gibs to the inside surfaces of the uprights or housings. A flange on the back of the crossrail extension is provided with bolts working in T-slots in the inner faces of the uprights. Tightening these bolts draws the uprights against the crossrail, which also is secured to the face of the uprights in the ordinary manner. This method of bolting brings into play the strength of the housing to resist the torsion of the crossrail, and the crossrail stiffens the housing against the twisting action of the side heads. The effect is an enormous increase in the strength of the combined parts. In some 54-inch planers of this construction, two cuts of 60,000 pounds each were taken in steel, without any perceptible spring of the crossrail, altho it was scarcely larger than is usually provided for a planer of that width.

GENERAL FEATURES.

The machine is provided with two tool heads on the crossrail and one on each of the housings. Each of the two saddles has its own feed motion, independently adjustable in direction and amount. Each has also its own stopping and starting device, but the planer is so arranged that all of these can be thrown out of action or into action simultaneously by the motion of a hand lever, and this can be done from either side of the planer. The table is supported in one flat and one "V" bearing, which are provided with a forced system of lubrication by means of a pump with circulating pipe system, oil tank and filters. The "V" bearing has four surfaces, two forming a "V" of large angle, sufficiently inclined to guide the table under ordinary circumstances but having the minimum wedging action. There are also two nearly vertical sides which do not bear under ordinary circumstances, but are ready to resist side cuts which are sufficiently heavy to slide the table up on the "V" so as to bring the vertical surfaces in contact. This arrangement permits the table to run lightly under ordinary work, but prevents it from lifting under any condition of heavy side cutting. The total weight of the machine is about 60 tons.

Studies in Inventive Problems—IV.

Proposed by Leicester Allen and Solved by Various Readers.

Several correspondents, some of whom have contributed solutions to Problem I and one or two who have not, call my attention to an error in my remarks relating to Mr. Gearing's solution at page 5, in which I said (in substance) that the forkways of his lever *c* should be curved. Re-examination of his solution shows that I was mistaken, for which I offer my apology to Mr. Gearing. The mistake arose from the erroneous impression that the pin *f'* was attached to the lever *d* and moved with the latter, instead of being rigidly attached to the lower end of the bar *e*. I see by a re-perusal of Mr. Gearing's description that this supposition was not justified. I thank those who kindly called my attention to this.

I have also been "called down" for implied ambiguity in my statement of the problem on page 1621, Vol. 27, tho only a very few out of all who have attempted solutions seem to have misunderstood the statement. The language criticised is, "in any portion of space lying below the horizontal part of the path and to the right of the vertical part of the path it is required to design," etc. In reviewing this statement, it seems to me it expresses clearly enough the requirement of position, especially when supplemented by the last paragraph in the general statement, which gives the reason for thus limiting the position. One correspondent complains also that I have permitted the violation of this condition in Solution No. 2. Strictly speaking, this criticism is just. A part of Mr. Deats' mechanism occupies inhibited space; but as the solution does not practically encroach upon the space above and to the left of the guideways, which is supposed to be occupied by other mechanism, and as I did not wish to discourage anyone by hypercriticism, I decided to admit it, partly on this account, and partly from the desire to test the critical scrutiny which the publication of the solutions is likely to call forth.

Some two or three correspondents object to the word "path" as applied to the line described by the geometrical center of the sliding block; but this use of the word accords with general usage in standard treatises on mechanics and physics, and I see no valid reason why it should not be so employed. For instance, the path of a projectile would be the line described thru space by its center of gravity; and the center of gravity in a homogeneous body of regular form, as a cube, sphere, etc., coincides with its geometrical center.

James W. Brown, of Camden, N. J., criticises the proportion of the fork on lever *c* of Mr. Gearing's mechanism as not being of a "sufficient length to allow the block *a* to travel a horizontal path equal to twice its vertical movement," and adds that "with cams and levers as shown, it would not be a very practical arrangement, if the movement was for any considerable distance." But "considerable distance" is not implied or demanded by the terms of the problem, and exact proportioning of parts is not expected in diagrams illustrating solutions, unless such proportioning is found necessary to show the working principles of a device. But another criticism of Mr. Gearing's solution, made by Mr. Brown, is valid, and is "that if there were resistance to the vertical movement of block *a*, the angularity of the working face of the fork of lever *c*, as presented and applied to roller *f'* at the end of bar *e* would tend to twist the block *a* in its guides."

H. V. Haight, of Sherbrooke, Quebec, thinks some other conditions ought to have been included in the statement of the problem, among which he says the solution "should permit any desired ratio of the time required for the vertical part of the motion to that required for the horizontal part, or any desired ratio between the average velocity and the velocity in any point in the path." Of course this condition and others might have been included, and, in framing the problem, this point was considered; but, in the beginning, I thought it best not to complicate the problem with collateral requirements not essential to the accomplishment of the movement as set forth. In the study of a new movement the first thing is to reason out some way whereby it can be done. The study of the best way is secondary in order of thought.

A. E. Alford, of Providence, R. I., writes that "in the solution of these problems no considerations as to practicability of design or requirements of the problem should be lost sight of." Of course, practicability is a desirable quality; but, if included as a condition of the solutions, it would probably exclude many which either contain or imply good constructions, because it is not expected that more than a few who attempt solutions can afford time to accurately lay out and carefully design these constructions, as they would if required to put them to the test of actual practise. I think it quite sufficient for the purpose of these studies if the methods proposed are thought out to an extent that clearly shows them to be mechanically operative within the stated limits, and it is more than likely that I shall accept some solutions which more mature consideration of all points involved would exclude." Mr. Alford further makes the following criticisms of the three solutions presented at pages 4 and 5.

"The first is the only one which could be worked into shape to comply with all requirements. No. 3 could not be made to run fast with resistance to the block,

on account of the method of transmitting motion from the mechanism to the slide. Practically the same objection can be made to No. 2, with the added fault that, at the reversal of the movement, there will be a slight rest on account of the flexibility of the chain. A chain, like a belt, is designed for tensile strain only, and where a component of the stress falls outside of the line of the links there is bound to be trouble. An objection which can be applied to both the first and second solutions is that part of the operating mechansm is in the space above the horizontal, and to the left of the vertical branch of the path. In No. 1 lever *d* swings into said space during the horizontal movement of the sliding block, and in No. 2 a sprocket and part of the chain are permanently located in the space. In my study of the problem a solution very similar to No. 1 occurred to me, but was discarded because of the above objection. In No. 1 we are at a loss to know exactly how bar *e* is located, whether rigidly fixed to the sliding block or swinging with lever *d*. In neither case would the forked portion of lever *C*, in its stationary position, be concentric with shaft *m*. If rigidly fixed to the block the lower end of bar *e* would move horizontally and parallel with the block. If flexibly attached to the block and sliding on lever *d*, its lower end would describe an irregular curve, being moved by the radial motion of the lever and the horizontal motion of the block. But this solution has the great advantage of positive motion throughout the travel. It is also less intricate than the others."

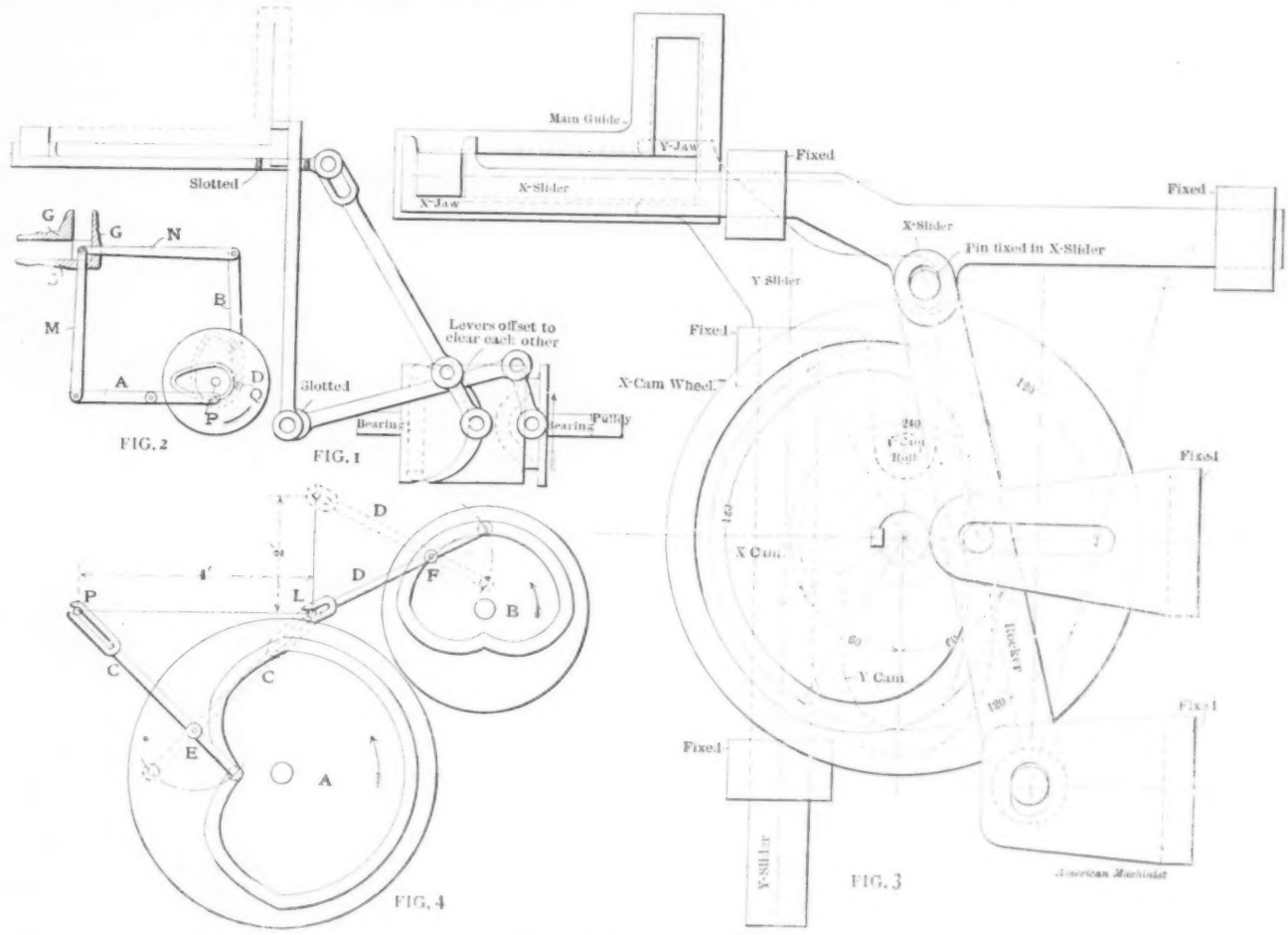
SOLUTION NO. 10, FIG. 1, GRANT CLARK, BARRE, VT.

Mr. Clark sends very little explanation besides his sketch, which he thinks is self-explanatory; but he adds the remark that "in a working machine suitable guides for the arms would of course be provided, as would be also supports for the fulcrum of the arm-operating levers and proper bearings for the cylindrical cam." He further writes that "the design of the cams gives the slides a harmonic motion, preventing shocks at the ends of the ways and at the angle. The block makes one movement in the short way in half the time required in the long way. Each arm is stationary when the other is moving, thus saving wear and power."

I think that while, at first, with fine workmanship, this would work all right, a very slight inaccuracy in forming the cam groove, or a very slight amount of wear in the groove, or of the cam roller, or the roller pin, would act to give a momentary stop at the angle, and that would be contrary to the stated requirements. The several wearings would act cumulatively to increase this defect; but as the problem specially speaks of probable wear as not to be considered, I merely point out this probability, while accepting Mr. Clark's solution.

SOLUTION NO. 11, FIG. 2, WALTER J. SPIRO NEW YORK CITY.

Mr. Spiro sends two solutions. One of these, a crank-and-link combination, must be rejected because nothing to prevent the tilting of the sliding block when near the turn is apparent. The other, a cam-lever-link mechanism, applies its force so nearly in the direction of the motion of the block when near the turn, that I think no special difficulty of this kind would attend its use. Mr. Spiro writes:



SOLUTIONS OF PROBLEM NO. 1.

"The rotating member is a disk *D* having two cam slots milled in its opposite faces. The pivoted levers *A* and *B* have pins, *P* and *Q*, which slide in these slots, and the motion thus imparted to these levers is transmitted to the block *S* thru the connecting rods *M* and *N*. It will be seen that each cam slot has a sensibly circular portion 180 degrees in extent, the remainder of its path being elliptical. In the position shown, the pin *P* is just entering upon the elliptical, and the pin *Q* upon the circular portion of its path. Thus the ensuing half rotation of *D* will cause lever *A* to vibrate and return to its primary position, while lever *B* remains at rest. That is, *S* will be caused to travel

thru the vertical portion of its path. During the next half-turn B will oscillate while A stands at rest, and this will cause S to reciprocate over the horizontal part of its journey. Of course, when the lever B is rocked, the lever A also must have a slight movement, due to the rocking of the pitman M which is pivoted to S, and similarly with the lever B when the lever A moves. This slight motion is allowed for in laying out the approximately circular portions of the cam slots. This solution has the advantage that it may be made to give uniform motion to the slide S, by giving suitable form to the cam slots in disk D."

SOLUTION NO. 12, FIG. 3, H. J. KENNEDY, BALTIMORE, MD.

Mr. Kennedy sends an excellent, complete solution, accompanied by two fine blueprints of a nice drawing, and an unusually well written explanation. I much regret that his time is so taken up that, as he writes, he will not be able to devote much attention to these problems; as I am sure from this specimen of his work, he would, by continued contributions, add greatly to the interest and instructive value of the series. But of course there are many men of his caliber who are too preoccupied in their regular work to afford the time for such a purpose. He writes:

"The horizontal movement of the sliding block is imparted to it by the X jaw formed on the end of the X slider, which is moved back and forth by the X cam thru the rocker. The X jaw delivers the die at the end of its stroke into the mouth of the Y jaw, which takes it on a trip up and down again, returning it to the X jaw, which takes it back to the starting point. The movement of the Y jaw is derived (thru the Y slider) from the Y cam, shown dotted, which is formed in the face of another wheel keyed on the same shaft as the X cam wheel, and having, in the drawing, the same diameter. The cycle of movements produced by the cams, starting in the position shown and rotating in either direction, is as follows:

Angular motion of wheel.	X-slider.	Y-slider.
120°	Moving to right.	Stationary.
60°	Stationary.	Moving up.
60°	Stationary.	Moving down.
120°	Moving to left.	Stationary.
360°		

"I laid out the cams to give harmonic motion, with the result that the inclination of the working edge to the line of action is in places somewhat acute, which for some purposes might be considered objectionable. This, however, is merely a question of proportioning, and not of the mechanical elements employed. Again, for some purposes the size of the mechanism in proportion to the stroke produced might be a drawback. Compactness is one of the directions in which I would work for improvement. With the proportions shown, and a uniform angular velocity of the wheel, the average velocity of the block during its horizontal motion will be equal to the average velocity during its vertical motion. A change in the cam angles would of course give a different relation between these velocities, if desired. The skeleton of the mechanism has been clothed simply, merely as a demonstration piece; a machine to resist prolonged and severe wear and tear would require more careful detailing."

SOLUTION NO. 13, FIG. 4. FRANK DELLE, TERRE HAUTE, IND.

Another form of cam-and-lever mechanism. Mr. Delle explains: "A and B are cams which run in the same direction and make an equal number of turns. They are constructed so that the arms C and D alternately remain at rest during one-half a rotation. E and F are two fixed points about which C and D work. P is the position of the crosshead, or sliding block, at commencement of operations. When the cams have turned thru one-quarter of a revolution the arm C will have moved to position C', and P will be at L. In the next one-quarter turn D will move to D' and back again to D, taking P from L to M and back again to L. During this time the arm C has remained at C', but in the next quarter turn it will move back to the position C, carrying P back to its original position and thus finishing one complete movement of the block."

The remark previously made with reference to exact workmanship and wear applies to this solution also, as it does to nearly all mechanisms which use cam movements and alternately engage and disengage the sliding block at the angle in the path of movement.

SOLUTION NO. 14, FIG. 5. H. V. HAIGHT, SHERBROOKE, QUEBEC.

"The letter x shows the three principal positions of the sliding block. The two cranks A and B, working thru the connecting rods E and F, oscillate the levers G and H. The latter, thru links j and k, move the blocks L and M back and forth in their slides. These blocks carry latches P and Q, held up by springs R and S. When the two blocks L and M reach the

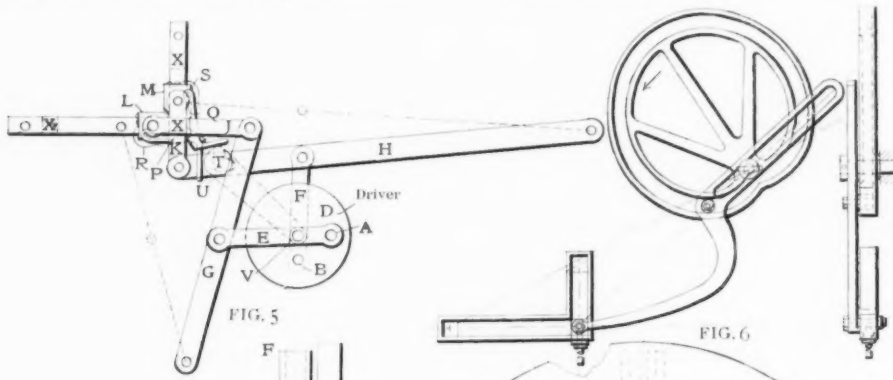


FIG. 5.

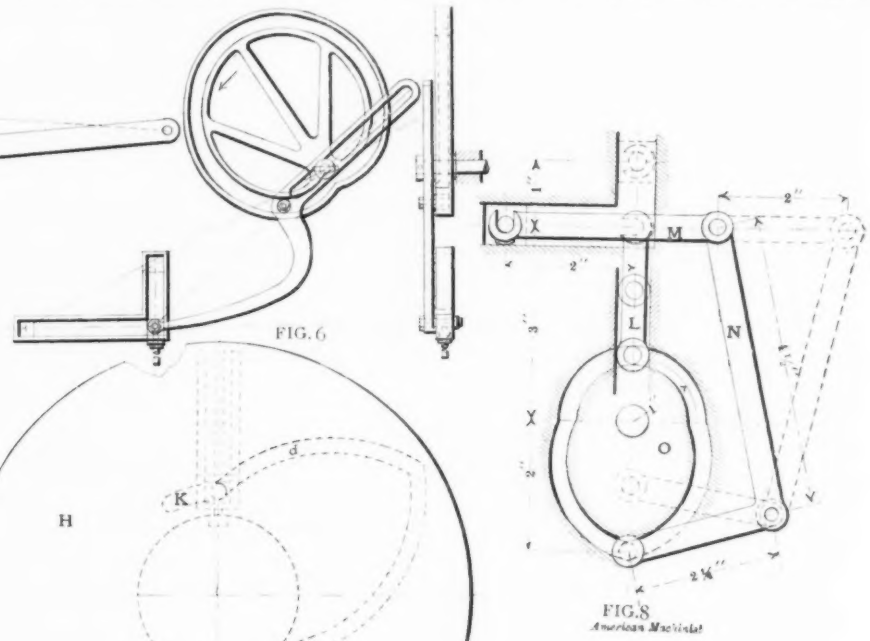


FIG. 6.

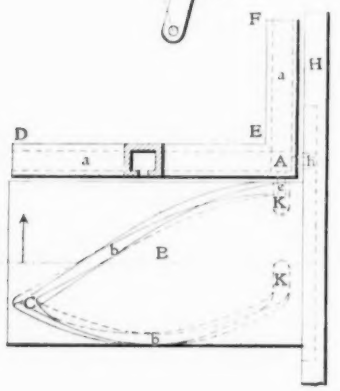


FIG. 7.

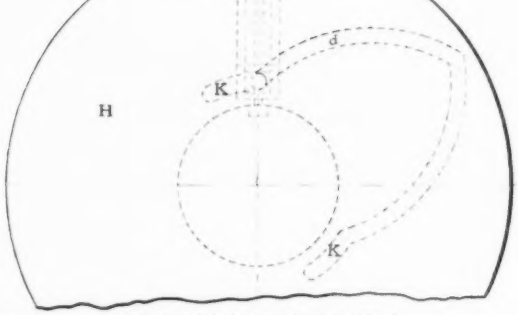


FIG. 8.

SOLUTIONS OF PROBLEM NO. 1.

corner, one of the latches is disengaged by cam T, driven by two-to-one sprockets U and V. The block X is thus picked up by the latches at the corner and carried to the end of the horizontal line and back, then picked up and carried to the end of the vertical line and back. In practise, cranks A and B would probably be replaced by eccentrics, or perhaps B only would be replaced, it being of shorter throw than A. The sprocket U has twice as many teeth as sprocket V."

This is the first example yet received wherein the sliding block x is actuated by auxiliary sliding blocks, which is, I think, a germ from which a very good movement could be worked out. The latch detail in this solution does not apply the force moving the sliding block at the corner; consequently, when the motion of the block is resisted there would seem to be a tendency of the block to bind in the ways. But this application of the force could probably be changed to a central line by study over a practical drawing. Mr. Haight sends also another solution whereby the movement of the block is effected by a cam, rock-lever and link motion; but it is not sufficiently elaborated to be available for publication, and indicates no means of holding the block from tilting when turning the angle of the path.

SOLUTION NO. 15, FIG. 6. FRANK WOODLAND, WORCESTER, MASS.

This is a simple and striking solution, described as follows: "The arm which actuates the square sliding block is provided with a stud at one end made to run in the sliding block, the other end carries a cam-actuated roller. The arm is slotted and straddles the shaft upon which the cam is secured. The cam shaft, being placed in the position shown, a line drawn thru the center of the shaft, cam-roll, and square sliding block, forms such an angle with relation to the guide-ways that force exerted endwise on the slotted arm in either direction will cause the block to slide in one continuous movement from one end of its path to the other. The sketch shows a heart-shaped cam for obtaining this reciprocating motion. When the cam is in such position that the roll is at the point where the cam groove is greatest in diameter, the sliding block will have traveled to the extreme left-hand end of the horizontal path; and when the roll is at the point where cam groove is smallest in diameter, the sliding block will be at the upper end of the vertical path. The cam can be made of such shape as to slow up the motion as the block approaches the square corner of the slide from either direction, thus eliminating noise when running at high speed. Rigidly secured into, and extending from, the under side of the square sliding block is a shank which runs thru a hole in a secondary block sliding in dovetail guideways shown in end elevation. This secondary block travels horizontally only, and, together with the shank in the square block, prevents the said square block from tipping as it goes around the square corner of the path. The slotted arm is curved at its lower end so that no part of it will come inside of the space above the horizontal guide, as that was part of the requirements."

SOLUTION NO. 16, FIG. 7, THOMAS L. COWLES, SPRINGFIELD, MASS.

This also is a striking, and, as I think, a satisfactory solution. "The horizontal and vertical guides are indicated at a a. A is the sliding block. Roll e on the lower side of block A engages in the helical groove b in the cylinder B, which rotates as indicated by the arrow. Starting with the roll at C, in groove b, one-third of a revolution carries the block A from D to E, where the roll h on the end of the block A engages in the groove d in the cam disk H. Another third of a revolution carries the block A to F, which is one-half the distance DE, and back to E, where the roll e again engages in the groove b, and the remaining third of the revolution returns the block to D, completing the desired course. The parts of the grooves marked K must be left concentric to the cam axis, so that the rolls may enter one groove and draw out of the other as the block starts on its new direction. The block A is now in position to be returned to D."

SOLUTION NO. 17, FIG. 8, F. C. HENDRICK, CHICAGO, ILL.

Requesting the indulgence of Mr. Gearing, who contributed solution No. 1 of this problem, Mr. Hendrick offers his solution as similar in principle to Mr. Gearing's, but as an improved construction. It is also similar in principle to solution No. 12. Mr. Hendrick writes that, as he understood the problem, Mr. Gearing's solution did not entirely conform to its requirements, "in that, while operating the upper end of the fork on the lever, d projects into forbidden territory." In Mr. Hendrick's solution "the sliding block is shown at the end of its horizontal travel. As cam O turns in either direction thru 90 degrees of arc, N is moved to the position shown in dotted lines, and by the connecting rod M the block is drawn to the intersection of the horizontal and vertical branches of the path. The lever N now remains at rest, and the block is given its vertical motion by the same cam thru the connecting rod L, the lower end of which runs between the guides. As shown, the end of each connecting rod, where it engages the pin on the sliding block, is left open on one side, so that the rod which is at rest becomes disengaged from the pin. The rod acting on the block is kept in engagement by a projection abutting against the side of the guideway, as indicated."

In England "petrol" is gasoline, kerosene is called paraffine, and alcohol is spirits of wine. We ought to "get together" if possible on these names for things in such common use.

Evidence of Enlightenment.

Perhaps the most notable of all the contract requirements for the Pittsburg filter contracts are those relating to the sanitation of the contractor's camp and the health of the workmen. Laborers' quarters must give at least 300 cu. ft. of air space per sleeper, have tight floors at least 1 ft. above the ground, have for each camp a separate building for wash house or laundry, and another for a kitchen or cook house. No stable shall be nearer than 150 ft. to any of the buildings just named. Pure water approved by the city authorities must be supplied to the workmen, all garbage must be stored in "tight" receptacles and burned without nuisance once in 24 hours. Water closets must be provided for all laborers, subject in all particulars to the control of the city authorities, and must be connected with "tight" septic tanks, effluent from which must be "reasonably clear, colorless, free from disagreeable odor and entirely unobjectionable to run out to a water course." Medical supervision and care of the workmen, the removal of men suffering with communicable diseases and the employment of no unvaccinated men is also required. These sanitary regulations are highly commendable, and for the interest of the contractor as well as the city. The rules for water supply, garbage and sewage disposal, if effectively carried out, will reduce the dangers from typhoid fever, both to the workmen and to the city water consumers after the reservoirs and filters are put in use. E. W. Bigelow, M. Am. Soc. C. E., is Director of Public Works of Pittsburg, and Mr. Morris Knowles is Chief Engineer of the Bureau of Filtration.—*Engineering News.*

A machinery company in Boston sold a machine to a factory in Canada and sent a skilled machinist to put it in good running order. The workman was taken with a serious illness and was obliged to return. The superintendent of the factory succeeded in erecting the machine so that it looked all right, but it did not run smoothly, and gave out a curious, rasping noise. The manufacturers were in despair. Finally they decided to consult the Boston machinery company over the telephone, called them up and told them that the machine refused to run smoothly, and that it was making a curious noise. "Something is the matter with the way you have set it up," came the answer. "But wait a minute. Extend your telephone wires into the room where the machine is running. Our expert is here, and we'll have him listen to it." This was done. The machinist of the Boston company directed in what positions the receiver of the telephone should be placed. Suddenly his ear caught the sound which came from the seat of the trouble. In a few seconds he had told the Canadian company the mistake that had been made in assembling the machine, and in a few minutes more everything ran smoothly.—*Youth's Companion.*

The United States Arsenal at Rock Island—V.

BY F. A. STANLEY.

One of the most important of the many parts entering into modern rifle construction is the receiver to which the rear of the barrel is threaded, and in which plays the breech bolt that shoves the cartridge home and backs it up when fired and, in conjunction with extractor and ejector, expels the empty shell. This interesting member as applied to the new magazine rifle weighs just under one pound; the solid blank as forged under the drop hammer weighs over four times as much, and for shaping from the rough forging the light, yet strong, finished receiver, cutting away during the process over three pounds of metal, no less than eighty-four operations are required. In this section of the article dealing with the features of Armory Row, a number of the half-tones presented show different views in the department devoted to the manufacture of the receiver and give a good idea of the machinery therein operated.

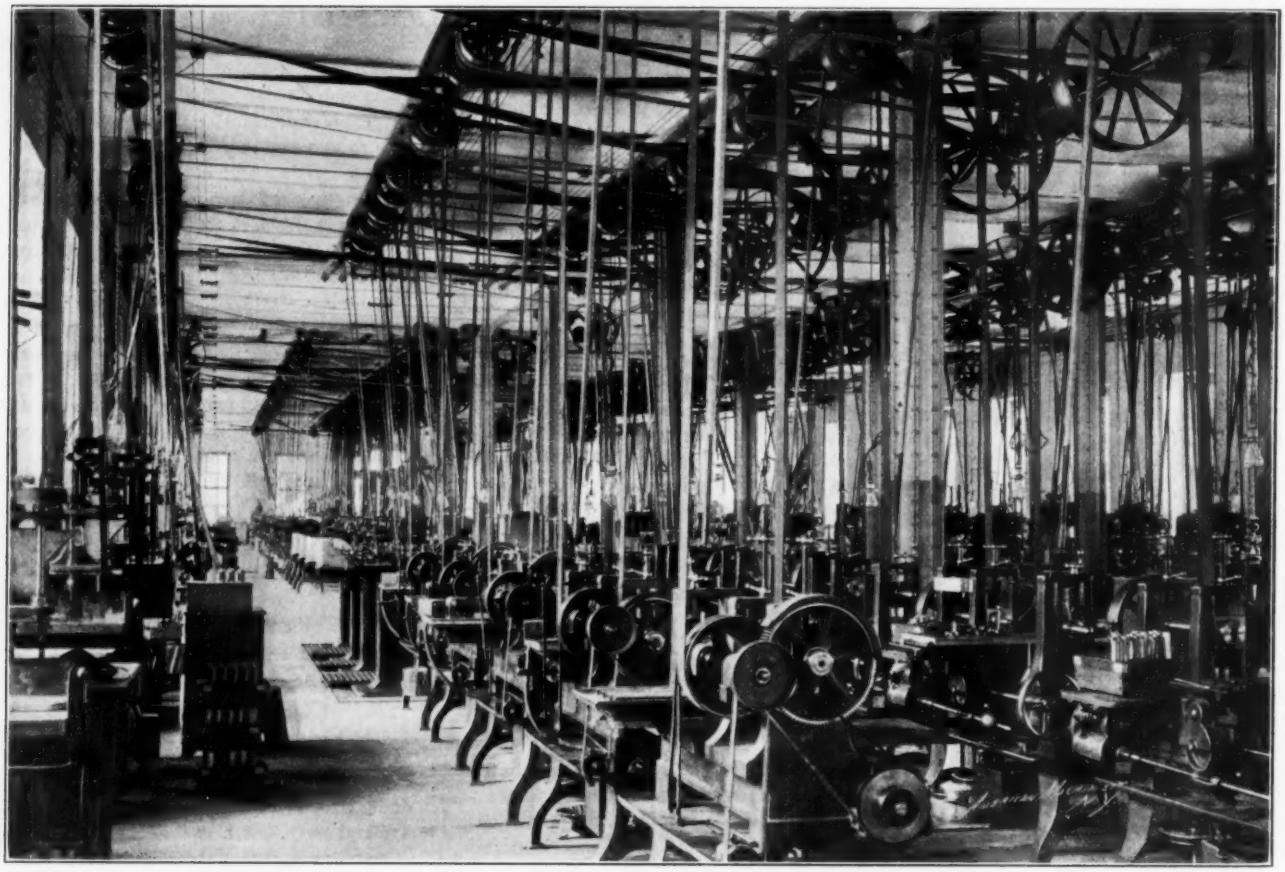


FIG. 36. VIEW IN RECEIVER DEPARTMENT.

THE RECEIVER DEPARTMENT.

This department, a general view of which is given in Fig. 36, occupies the first floor in the east wing of shop B, hence is directly across the courtyard from the barrel department illustrated in the preceding chapter. The drop-forged blanks as they are received here are trued up and faced and then in the machines shown in Fig. 37 are drilled out for the bolt, the ten machines in the group being P. & W. gun-barrel drillers of a short pattern bed and specially adapted to work of this character. In the background of the photograph will be seen a number of upright machines which are used for reaming the bolt hole in the receiver and for counterboring and tapping its mouth to fit the threaded end of the rifle barrel.

RECEIVER MILLERS AND SPLINERS.

The view in Fig. 36 illustrates clearly a portion of the milling department on this floor, and shows a large number of Hendey millers of the Lincoln type, for taking a variety of cuts over the receiver after it is bored out. While there are about sixty machines in the double row shown, this interesting group is only one of a number containing similar machines, for there are two hundred or more such millers in the building. Midway of the battery of millers is a group of horizontal spliners, four of which are visible in the engraving. They are of Pratt & Whitney make and are used for cutting the grooves in the rear of the receiver to allow the lugs on the bolt to clear when that member is drawn back. This type of spliner is constructed and actuated in much the same fashion as a rifling machine, except that the tool bar is drawn straight ahead instead of being given the combined rotary and longitudinal movement necessary to produce the helical groove in the barrel.

SOME PROFILERS AND OTHER TOOLS.

At the far side of the room will be noticed a row of profilers (also made by the Pratt & Whitney Company), and Fig. 38 is a view down the front of this line of double spindle tools, another view taken from the rear of the profilers and showing several vertical slotters in the foreground and middle distance being given in Fig. 39. The latter engraving also brings out clearly the method of driving line shafts at the arsenal, the ceiling motor being belted to a jackshaft which is belted back to the main line and which carries the pulleys required to give the necessary speed reduction. As will be noticed, each machine illustrated in the two views is provided with a conveniently located stand upon which boxes of work may be placed; and inside of these cabinets provision is made for taking care of tools, wrenches, etc., required by the operators. As is well known, tools of the profiler and slotter types, like Lincoln millers, are peculiarly adapted to many of the operations necessary in the manufacture of rifles, and are particularly useful in shaping certain portions of such pieces as receivers and guards; and I believe that a hundred or more of the two

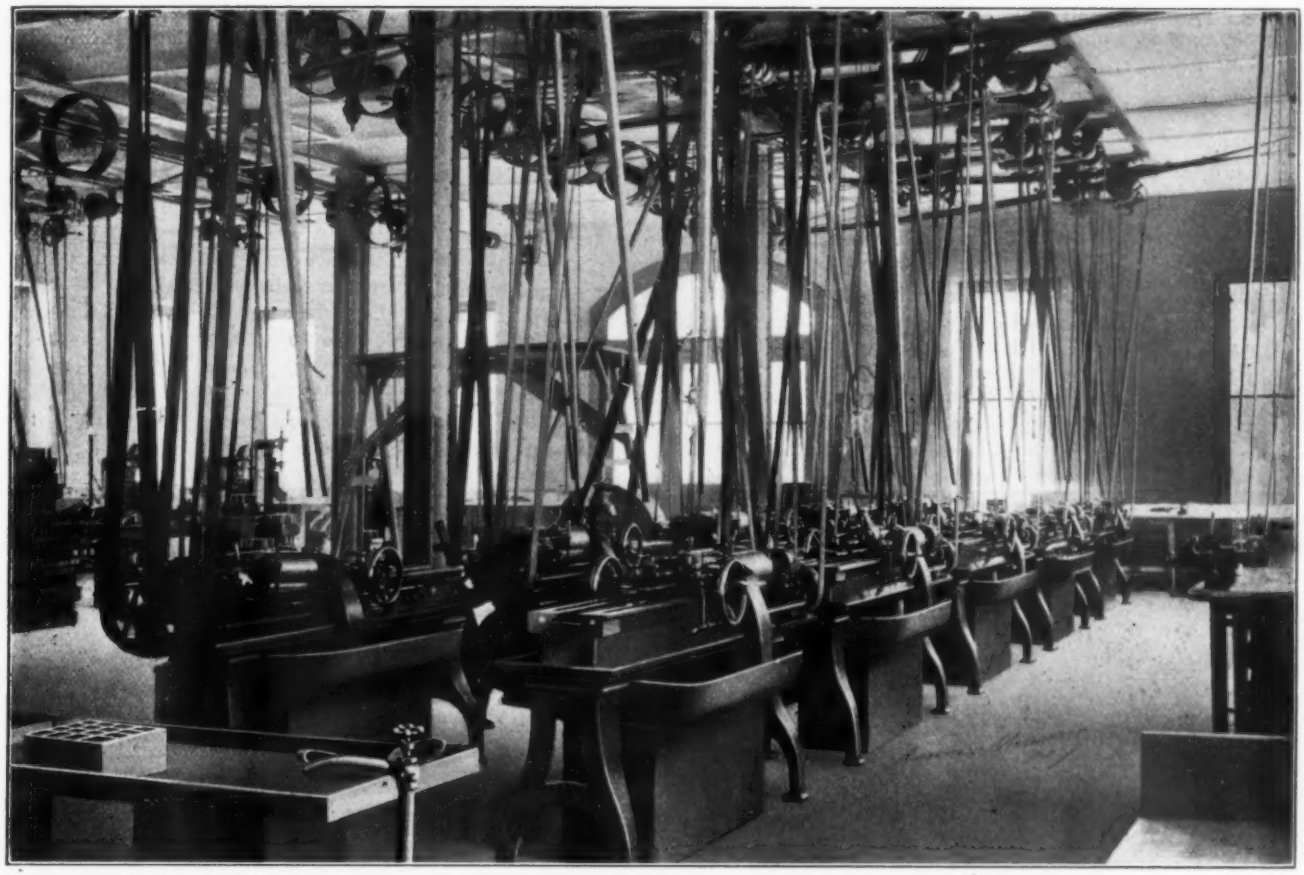


FIG. 37. GUN BARREL DRILLERS ON RECEIVER WORK.

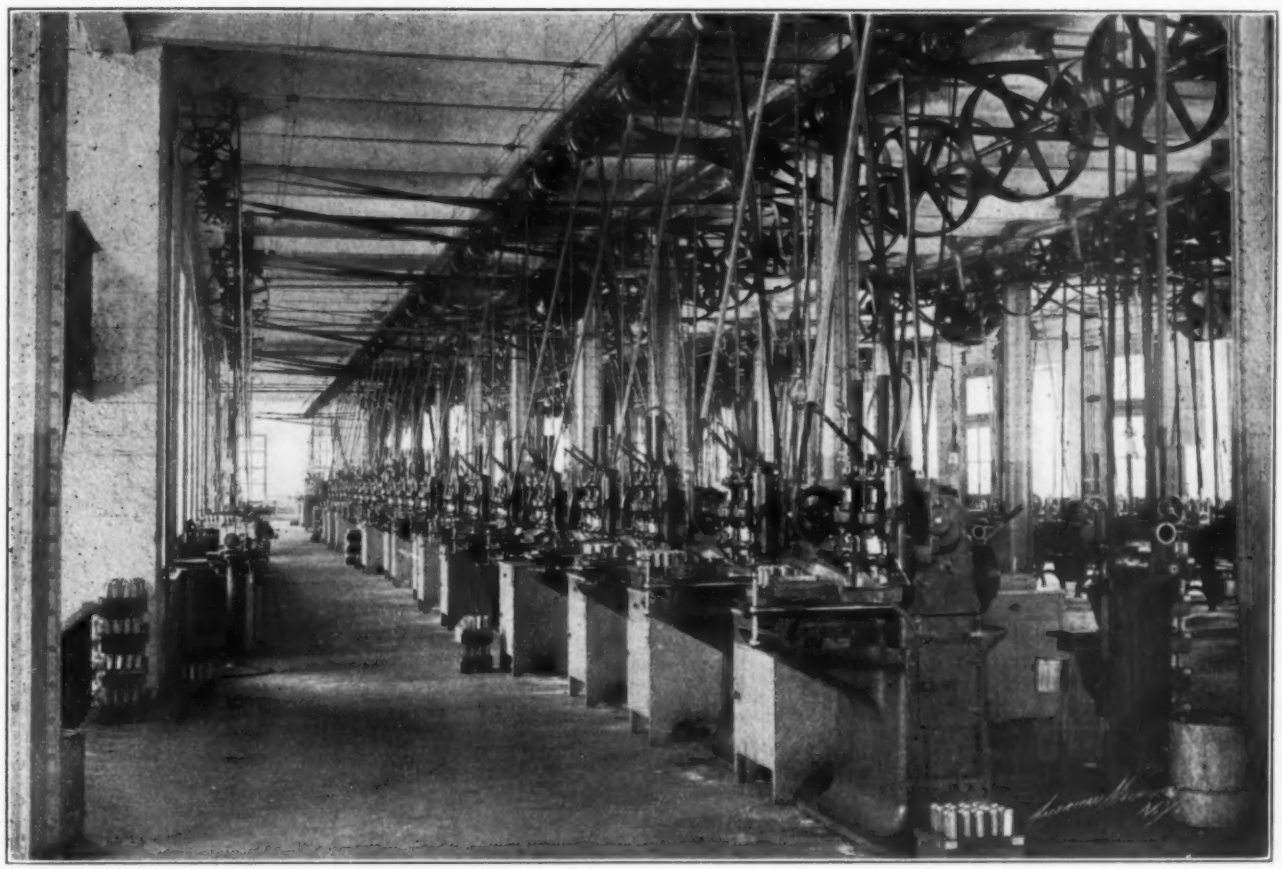


FIG. 38. PROFILERS IN RECEIVER ROOM.

spindle profilers illustrated are installed in the different departments of this small arms plant.

Another interesting view in this room is that reproduced in Fig. 40, where several hundred receivers which are well along toward completion are piled up at the side of the gang drills under whose spindles various small holes have been, or will be, drilled, reamed or counterbored. One of the drill jigs with a piece of work in position is clearly shown on the table of the drill press in the foreground, and is typical of a multitude of special appliances of somewhat similar character and which enable the manufacture of the rifle mechanism to be forwarded with the greatest dispatch and at the same time insure interchangeability of the parts thus handled.

AUTOMATIC SCREW MACHINE DEPARTMENT.

The automatic screw machines are located in the guard department on the second floor of the building, or immediately above the gun barrel machinery, and a view in this room is given in Fig. 41, with the screw machines plainly shown in the foreground. While there are but about a score of automatics here, these, owing to their variety, form a group of considerable interest to any screw-machine man, for included in the number are Cleveland, Hartford, Spencer and Acme machines. Of the ninety-two parts making up the new rifle, over forty are produced on the automatics. This product naturally consists largely of screws, studs and pins, and, as might be expected, these are all held by gages to a close limit of accuracy.

EQUIPMENT FOR HANDLING GUARDS, ETC.

Fig. 42 illustrates a portion of the extensive miller equipment of this floor, and in addition to the machines represented in the half-tone there are a good many profilers, and hand and universal milling machines; for besides trigger guards there are finished here floor plates for magazines, front sight studs, rear sight bases, etc. As is the case with other departments, upright and sensitive drills are used extensively in this room; also, there are several hand screw machines which handle work for which the automatics are not adapted.

Reference has already been made to some horizontal spliners in the armory equipment; one of these machines is shown in front of the group of vertical slotters in Fig. 43, and is used principally for splining such pieces as sight studs or bases, which are located on the rifle by a key or lug formed on the barrel. The work is dropped into a suitable clamping fixture or chuck, and the reciprocating cutter bar with automatic feed for the tool does the rest. The parts machined by this tool are first bored out in horizontal machines of the gun barrel driller type, several of which are shown to the rear of the slotters, these machines being used also for drilling the firing pin sleeve and for performing a similar operation in certain other parts of the rifle.

FIG. 39. SHOWING PROFILERS FROM THE REAR, AND A ROW OF SLOTTERS.

Specialization in Manufacture.*

The industrial structure may be compared to that of a tree. The organization of the industry corresponds to the roots, the common basis and development to the main stem and the special lines of manufacture, which are from time to time added as the business grows, correspond to the branches. Formerly it was the ambition of the manufacturer to add as many new branches as possible, so that the plant might cover a larger field, and also because of the supposed advantage that in case of a temporary falling off in demand for products of one kind, the establishment might be kept occupied continuously through a balancing demand for another product.

This plan undoubtedly possessed certain advantages, but it also had serious drawbacks. In the case, for example, of the manufacture of machine tools, where a great variety of machines, such as lathes, planers, etc., are made, of different sizes and shapes to suit the wants of many customers, the result is, sometimes, the

*Abstract of a paper by Alexander E. Outerbridge, Jr., from *Annals of the American Academy of Political and Social Science.*

FIG. 40. RECEIVER DRILLERS AND JIGS.

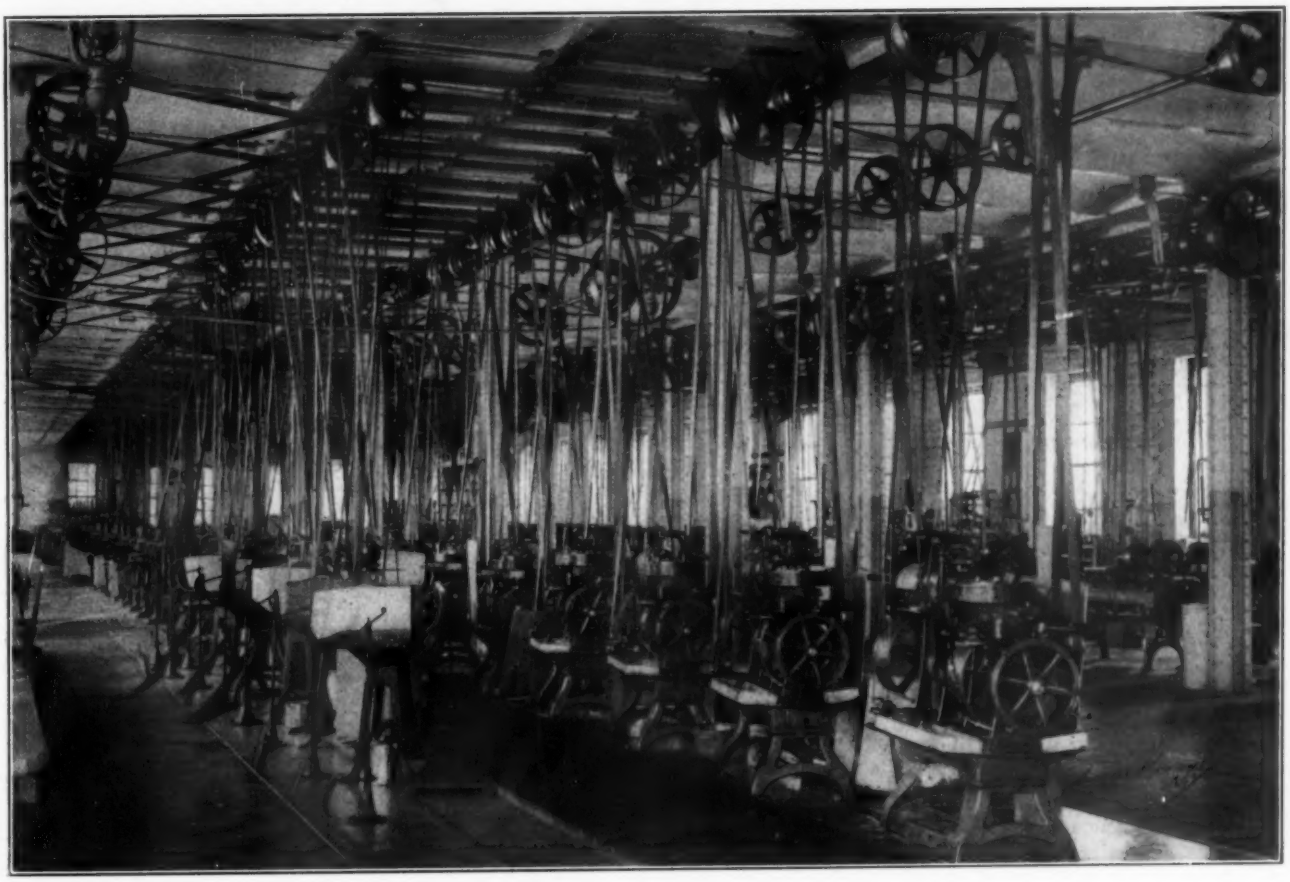


FIG. 41. AUTOMATIC SCREW MACHINES IN GUARD DEPARTMENT.

accumulation of an enormous stock of costly patterns and fixtures, which are kept in storage for years, perhaps without duplicate orders therefor, and these are finally destroyed to make room for other similar but newer accumulations. When a single new machine is ordered, it is customary to make duplicates of many of the parts. These duplicates are carried in stock for future use, sometimes for years, until, in fact, the design becomes obsolete, and then the patterns, fixtures and duplicate parts, which represent a large original investment of money and a continual expense for interest, storage, insurance, etc., are condemned to the scrap heap.

Specialization in manufacturing has become a prominent feature in recent years, now made by a machine-screw company by welding electrically the head (cut from a bar of hexagonal steel) to the body of the bolt, made from a piece of cold rolled steel the exact diameter of the bolt, and sold for $5.88, which shows a saving in favor of this process of approximately 63 per cent.

Certain cores which formerly cost $1.18 each, now cost 30 cents each. Others which formerly cost 56 cents each, now cost 14 cents each; others which formerly cost $6 each, now cost 90 cents each, and so on. Specialization here led to the adoption of new processes.

When Edison first made the small incandescent electric lamps, consisting of a carbon filament fixed by platinum wires in a pear-shaped glass bulb, from which the air had been exhausted, the cost was $3 each; now there are many million similar lamps of better quality made each year and sold at less than 20 cents each. Formerly watches were made by hand and were costly luxuries; now they are made by machinery in lots of a thousand at a time, and the cost of a new watch, that will keep fairly good time, is less than the cost of having an expensive watch cleaned.

Not long ago a well-known English manufacturer visited this country to inspect our methods, and on his return he was asked "What is the secret of America's success in manufacturing?" His reply was the single word "scrapping," by which he meant that all appliances were considered obsolete in this country and condemned as soon as new improvements were found. It may be stated as a general proposition that if a new machine be invented which will, by increasing the output only 10 per cent., reduce the cost an equal amount, it pays to scrap the old machine.

An establishment may have its capital tied up in a complete outfit of machinery designed to produce one article at the lowest cost, for which there may be a constant demand at a remunerative price. Then an ingenious inventor may design a new machine, or devise a new method of manufacture, which will, perhaps, produce better goods at far lower cost, and the utility of the old plant is at once destroyed.

In England, several years ago, a clever young chemist devised a new method of producing aluminum, using sodium as an intermediary agent, the cost of aluminum, being less than half that of reduction by methods then in vogue. A magnificent plant was erected, requiring an investment of several hundred thousand dollars. Before the manufacturing operations were fairly under way an American electrolytic process was brought out, doing away with the intermediary element and reducing the cost to a mere fraction of that by the sodium method.

A few years ago a new method of treating steel for cutting tools was devised,

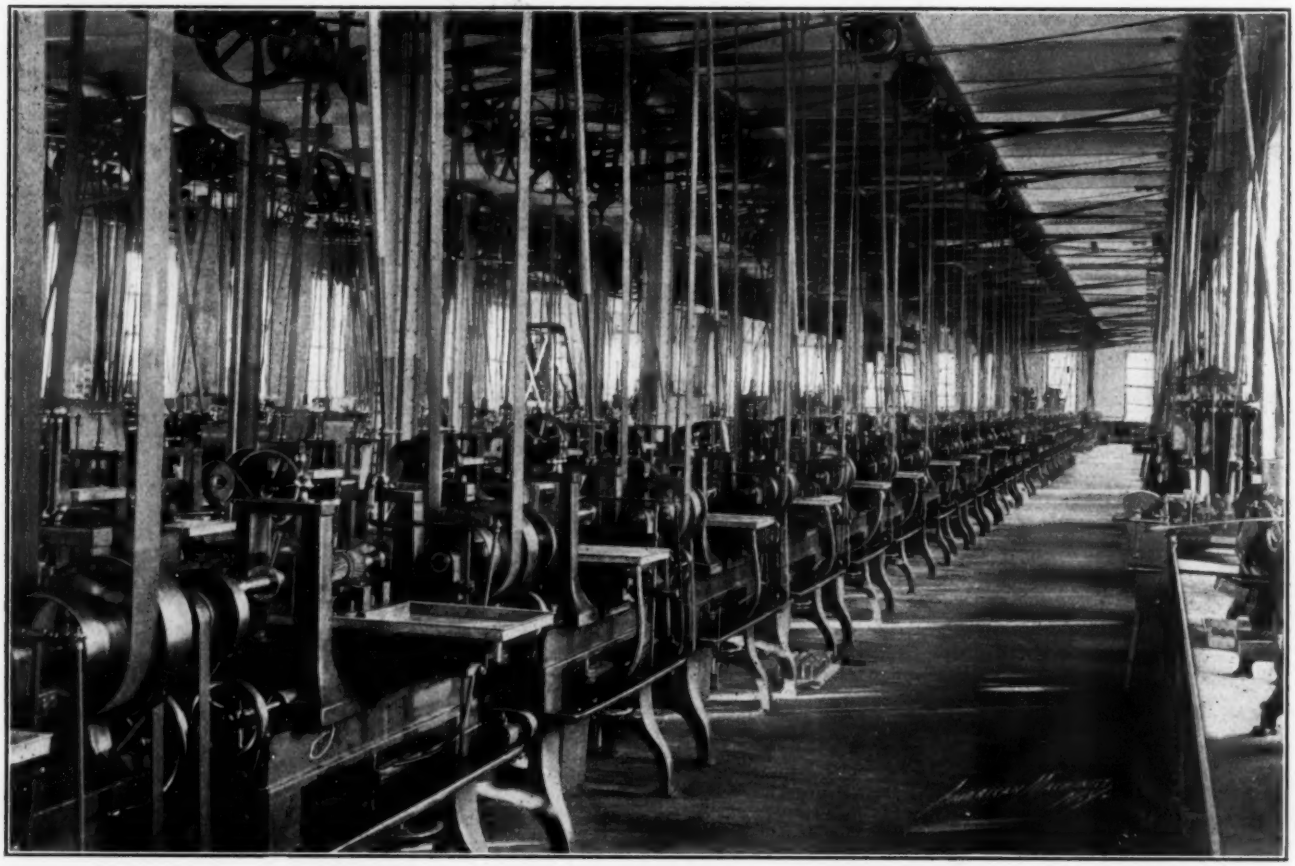


FIG. 42. MILLING DEPARTMENT FOR GUARDS, ETC.

resulting in an astonishing decrease in cost and increase in production. A few illustrations, taken from actual experience, of the advantage of quantity manufacture and undivided attention will be in point.

In making two oil pumps for hammer cylinders the cost is $20.19 each; the same pumps in lots of twelve cost $6.12 each, a reduction of 69 per cent., due largely to the increased quantity, and this reduction could be substantially increased if the quantity should be further increased.

For making one hundred ¾ inch by 4 inch hexagonal head finished bolts, on a modern turret lathe, by reducing the body of the bolt from a commercial bar of hexagonal steel of a size required for the head, the cost is $15.84. Similar bolts are

which enabled the tools to cut steel and iron four or five times as rapidly as could be done with any steel tools made up to that time. Shop rights were sold at large figures, and furnaces and other necessary appliances installed in several establishments for treating cutting tools according to this process. In a very short time new alloys were discovered, of which cutting tools are now made, having the same capacity without this costly treatment, and so the value of the process has been largely effaced.

The system of concentration of labor in large factories for making watches in this country is the antithesis of the method of scattered manufacturing which prevailed for centuries in Europe, notably in Switzerland. M. Favre-Peret, who investigated this industry in the New England States some years ago, stated that the average production of 40,000 workmen in Switzerland was 40 watches each per annum, while in America the average was 150 fine watches for each man employed.

By the aid of special machines in these watch factories, one man can make 1,200 fine screws per day, some of which are so small that more than 100,000 are required to weigh a pound. One of the finest pieces made is a "pallet-arbor" or pivotal bolt, which for a small-sized watch has a thread of 260 to the inch, weighs 1-130000 of a pound, undergoes 25 operations and costs but 2¼ cents. Measurements are gaged to 1-25000 of an inch.

The balance wheel, after being machined, weighs only 7 grains, and when fitted with 16 gold screws weighs 7.2 grains; there are 80 separate operations upon a balance wheel, 66 of them being drilling, threading and countersinking holes; the drills revolve at a speed of 4,800 turns a minute, and one operator can drill upward of 2,200 holes for the balance wheels per day. A full and complete report upon this highly specialized manufacture of watches in this country may be found in Volume II of the "Tenth Census of the United States."

Until 1850 shoes were for the most part made in the Bay State by farmers working at home at seasons when farm work was slack. Little by little manufactories were established, until now everything is done by machines, which are marvellous in their variety and rapidity of production. Here specialization has been developed to the highest degree. One factory employing 233 hands produced 2,100 pairs of shoes a day.

A delegation of French workmen, after visiting our industrial establishments, said, in their report, that "The manufacturers are unceasingly replacing old machinery by improved types. Although the McCormick Reaper Works are the oldest of the kind in the United States, we did not find there a single machine out of date. As soon as a machine can be replaced by one giving better results, a manufacturer does not hesitate to send it to the junk shop."

In all lines of manufacture in the United States the same tendency towards specialization is apparent, and it is a question for serious consideration whether this process may not be carried too far, resulting in the future in a variety of unlooked-for evils. Not the least of these perhaps is the decline of the "all-round skilled mechanic." Young men who enter our shops to-day find employment in tending special machines and soon become highly trained in their operation, so that they earn large wages, consequent, of course, upon their ability to turn out, by the aid of these machines, the maximum amount of work with minimum of defects. They are encouraged by their employers to continue at one job and feel little ambition to change to another class of work, or to another kind of machine, where their experience avails but little. Thus we have skilled planer hands, who know nothing about the operation of lathes, milling machines or other mechanical appliances in the same shops.

The tendency toward specialization is not confined to manufactures. It extends to engineering, medicine and other professions and occupations.

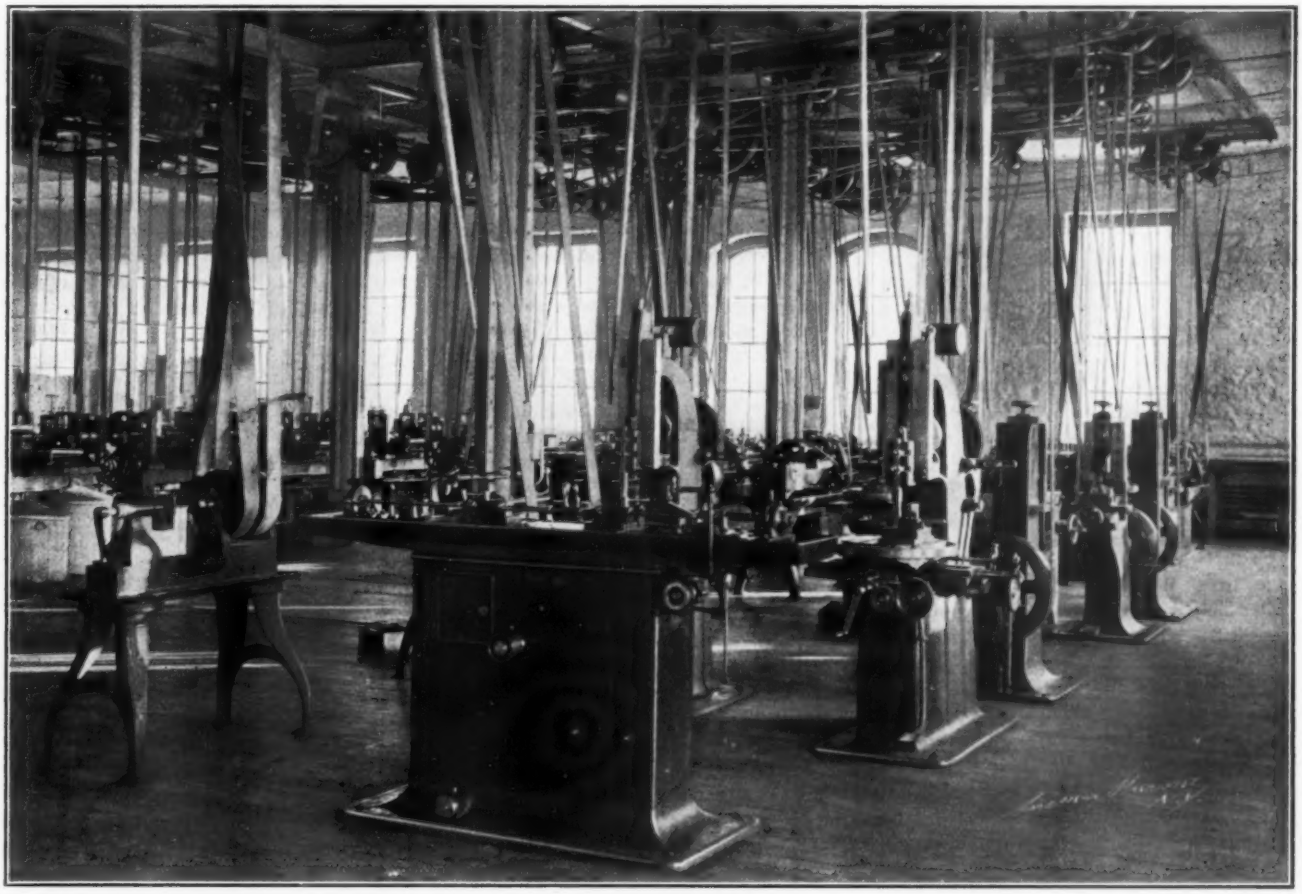
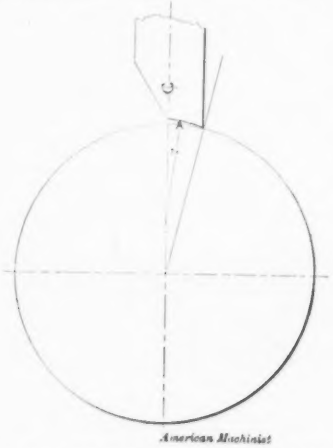


FIG. 43. SOME SLOTTING AND SPLINING MACHINERY FOR SIGHT BASE WORK.

Letters to the Editor.

Diameter of Hobs for Thread Dies.

Referring to the letter at page 163 on the "Diameter of Hobs for Thread Dies," my experience leads me to suggest that your explanation appended to the letter is somewhat incomplete. Bolt makers frequently (I might say *generally*) have the cutting edge of the dies set ahead of the radial line, in which case the diameter of the hob should be from .003 to .005 *small*. This is clearly shown, exaggerated of course, in the sketch herewith. When for any reason the cutting edge is set on or back of the center, then of course the large diameter is correct. ROY JOHN.



CLEARANCE OF DIE CUT WITH SMALL HOB.

A Typical Watt Engine.

I read with much interest the article at page 1322, Vol. 27, describing what the writer believes to be the oldest engine in America. Some time ago, as lately as 1899 or 1900, I came across a still older engine doing duty at the Douglas Bleachfield, Forfarshire, Scotland. This engine was considered by experts to be one of the best examples of Watt's earlier work. It ran until the firm gave up business, after which negotiations were opened by an American millionaire for its purchase and removal to this country. Several patriotic citizens thereupon subscribed the necessary amount to keep the relic of bygone engineering days in Dundee, Scotland, where it will most likely stay for good.

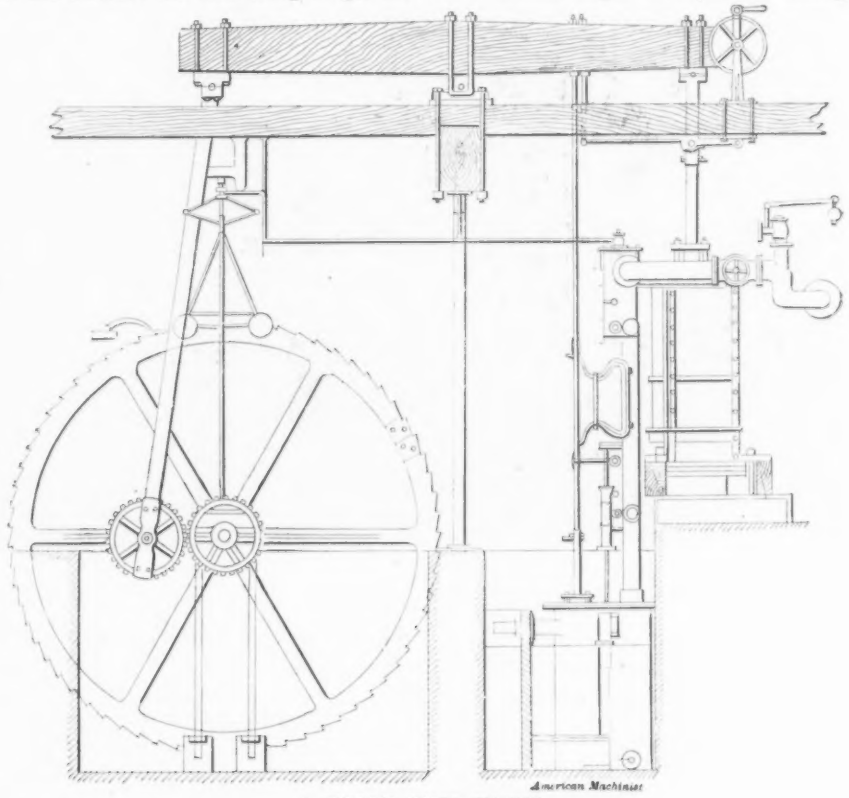
The engine, a beam condensing engine of course, was built by the famous firm of Boulton & Watt, of Soho Works, Birmingham, but in what year I could not discover. It was originally built for a Newcastle firm, and after doing duty for many years, was thrown out and poor old Scotland got it second hand. The date of its sale to Scotland was 1797, which without counting its English life would credit it with about a hundred years of active service. It is rated at 20 horse-power—"nominal" I guess. The steam cylinder is 20 inches diameter and 48 inches stroke, is effectively lagged and has an outer gray-iron casing to prevent radiation. The piston has the old hemp packing just like the ram of a schoolboy's pop-gun, and, this having to be renewed every six months, a crab was fitted up to facilitate the withdrawal of the piston. The parallel motion is exactly the same as in use in many English engines at the present day. The beam is a piece of good old oak and has all the fastenings made to it with wrought-iron clamps and bolts. The center gudgeon works in blocks carried in the longitudinal beams of the building and supported by a cross oak beam 10x12 inches held in position by gray-iron columns 6 inches diameter.

The connecting rod is of gray iron and made fast to the "planet" wheel which gears into the "sun" wheel, and is held in position by means of a wrought-iron link. This was a very ingenious invention of Watt to evade the crank which was at that time the patent of a Mr. Pickard. The piston makes 11 double strokes per minute and the crankshaft 22 revolutions per minute.

The governor is of the Watt pendulous type, working thru a series of levers on the throttle valve and revolving at a speed of 17 revolutions per minute. The fly-wheel is in halves and is rather striking in appearance, the arms being thinned off on the outside; the idea being to get the best effect from the rim of the wheel. The perifery is notched like an enormous ratchet wheel and has a pawl catching in the teeth and fixed firmly to the wall. This is necessary to prevent the engine running backward, a common occurrence with this type, and so damaging the machinery

The air pump is 13 inches diameter and 26 inches stroke, worked from the beam overhead. The injection or jet condenser has two sources of water, one constant from the mill stream, the other auxiliary from the cold-water well in which the air pump and condenser are placed.

The relief valve on the steam pipe is a substitute for cylinder drain cocks, which are not on this engine, and on starting the lever is raised and the condensed steam is blown off before opening the stop valve. The valve motion is worked by tappets from the air pump rod. Bolted to the vertical steam and exhaust pipes are two side brackets which carry the rocking shafts on which are keyed all the levers. The S-shaped tappets have handles fastened at right angles so that the engineer may move the valves when the engine is in any position. These tappet levers give motion to the rocking shaft which moves the valve levers coupled together with an adjustable connecting rod. The steam and exhaust are mushroom valves, and both moved in the same manner. There is a counterweight lever in connection with each tappet lever for taking the valve back into position when suddenly released. A primitive appliance is used for regulating the lift and fall of the counterweight on the rocking shaft and in connection with each counterweight is keyed an oblong-eyed lever thru which a leather belt 1½x⅛ inch passes, the bight, going round the opposite direction shaft, acts as a stop and is adjusted by means of a harness buckle.



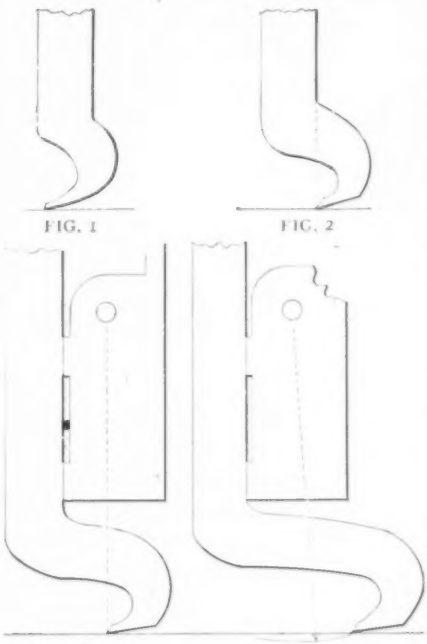
A TYPICAL WATT ENGINE.

A good tale was told me of a man who was one day sent from a machine shop to do some fixing on this engine. The same man had always been sent, but one day

he could not be got, so another machinist was sent to take his place. This man didn't know what he had to tackle and thought he would be all right taking a hammer, a chisel and a monkey-wrench with him. When he got out and saw all the straps, harness, buckles, etc., he called up the superintendent and said to him, "Hi, mister, it's a seddler you want and no' an engineer for this job." The machinist was not far wrong, and it took me quite a while to master the intricacies of the valve gear. RODERICK DHU.

Goose-Neck Tools.

In making goose-neck or spring-back tools for a planer, they are sometimes seen with the cutting edge set back more or less behind the front of the steel, some not enough and others too much. Fig. 1 shows the edge not set back far enough, which makes a tool worse for digging in and



GOOSE NECK TOOLS.

chattering than if made straight and solid. Fig. 2 shows a tool with the cutting edge just a little back of the back side of the steel, and if the planer head is properly adjusted this style works very nicely. A tool made as in Fig. 3 has the cutting edge on a vertical line with the center of the pin in the clapper box. This tool works all right, but there is danger of getting back too far, as will be seen in Fig. 4. The curve drawn from the center of the clapper box shows how the edge will kick into the work on the return stroke if not lifted up every time. When the tool thus kicks into the work the cutting edge must spring up just the amount it sweeps below its circle, thus dulling the tool and springing the job. When the tool is set too far back, it also loses its strength and the next cut will show wherever it went over a high place or took a heavier cut.

CAMERON.

Tools for Straight Lathe Work.

Noticing occasionally in the AMERICAN MACHINIST articles on the correct shapes for lathe tools, I would like to add my experience. The class of work I speak of is not done on a modern lathe specially built for the use of high-speed steel and with an unlimited amount of power, but on an ordinary machine where, to get the maximum output, careful attention must be paid to the shapes of the tools. The work on which the tools I describe may be used is machine steel ranging in sizes from 2 to 10 inches and upward in diameter, and from lengths like 5 or 6 inches, as in the case of small crank-pins, to 30 or 35 feet as in shafting.

For plain turning, as a straight shaft, I use three tools: the first to remove most of the stock the second to bring the shaft nearly to size, and the third to produce the finish. The roughing tool I shape like Fig. 1. It will be seen that it is somewhat similar to a side tool, except that it is more solid in shape and the angle of the cutting edge may be made more acute. The face *a* I usually grind to an angle of about 45 degrees, and face *b* about 5 degrees from the perpendicular. The front face I give a slight angle for clearance. The corner *d* may be rounded slightly. I use this tool with a feed of from 1-16 to ¼ inch, depending upon the length and diameter of the work and the amount of stock to be removed. In work such as turning bolts, where only moderate accuracy is required, this tool with the front face very slightly rounding may be placed with the corner a little above the center of the work and so set as to cut on the front as well as with the side face. By so doing a large amount of stock may be removed and a fairly good finish produced at one cut. I use water with this tool when used to finish at one cut, and always with the last two tools here shown. This form of tool has several advantages over the ordinary shape. It is easily forged, and its shape is such that it will almost feed itself along the shaft, thus saving wear on the feed gearing. As the cut is taken from the side, the work may be oval or the cut twice as deep on one side as on the other, a condition of affairs often found in turning forged shafting, and still the shaft be nearly round and not sprung out of straight seriously after the cut has been taken. If properly set this tool has no tendency to dig in; and even if it should do so on account of improper setting, it would dig sideways and not toward the center. Finally, this tool will carry a heavier cut than any other shape of tool I have yet found. With a tool made in this shape from 1x½-inch high-speed steel, I have removed 1 inch of stock with a feed of 1-16 inch, and could have taken a larger cut if the lathe would have pulled it. If, however, you have an old shaft with a keyway in it to turn up, don't use this tool, as it will cause you trouble till further orders.

The second tool I shape similar to the first, except that face *a* has not so sharp an angle, it being about 65 degrees from the perpendicular, and that the front face is rounded so as to do nearly all of the cutting. In Fig. 2 at *f* the shape of the front face of this tool is shown, and that of the roughing tool at *e*. I use this tool with a feed of ⅛ inch, removing 1-16 inch of stock and leaving the shaft four or five thousandths of an inch above the finished size.

The third tool is shown in Fig. 3, the front face being given about five degrees of clearance, and the top also having a slight amount of cutting rake. With some lathes the edge may be perfectly straight, but with others less rigid it must be made rounding enough so that the tool will cut along 5-16 inch or so of its edge. This tool may be used with a feed of ¼ inch or more on a heavy, rigid lathe. The proper hight to set this tool must be determined by experiment. If placed too low, it will chatter; if too high, it will not cut or else will dig in. The objection may be raised that with the tool ground rounding on the edge a helical ridge is left on the work and that this would be likely to prove destructive to the lining of a box. I have only one

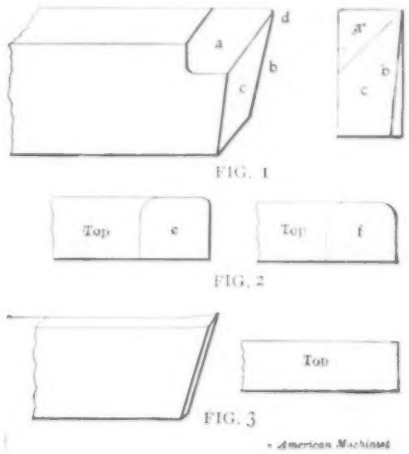


FIG. 1
FIG. 2
FIG. 3

TOOLS FOR STRAIGHT TURNING.

answer to make to this. The assumption is unwarranted. I have made and have seen large numbers of journals made with a finish of this character and have never known a case where trouble was caused by the helical ridge.

To illustrate the use of the tools I will suppose that a rough forged shaft to be finished to 6 inches in diameter and 12 feet long is given me. It has been cut off on one end and has about three-quarters of an inch of stock on it. I nearly always center work of this character while running in a steady-rest. I place the shaft in the lathe, with a dog to help the chuck do the driving, and center it first on the cut-off end. After centering I find the shaft not quite straight and so throw the end in the chuck over and proceed to spot a bearing for the steady-rest. The roughing tool is now used with a feed of 1-12

inch—my lathe won't pull much more—and with the first cut the shaft is brought to 6 1-16 inches in diameter. The cut is carried along the shaft up close to the chuck. When finished the carriage is run back to the tailstock and the steady-rest is set a short distance from the end of the shaft. The shaft is now turned end for end, the chuck is tightened on it, the rough end is faced and centered and the tailstock is run up. The chuck is now loosened so that the shaft is on the centers and driven by the dog. I have a center in this lathe which comes thru far enough to hold a shaft without its touching the body of the chuck. The unturned part which was in the chuck is now turned and a bearing is again made for the steady-rest. The shaft usually will run out enough to make this advisable. Tool No. 2 is now put in place. As the shaft is short enough to be fairly stiff, I speed up as fast as the lathe will pull and run the cut up to the steady-rest. My calipers are set to the finished size and I can tell by their drag when just enough to finish is left. The finishing tool, which is smoothed with an oilstone after grinding, is now used with a slow speed, as it tears if run fast. After this cut has reached the steady-rest the shaft is again turned end for end, the steady-rest is moved to the finished part and the shaft is finished with the two tools as before. If I have had good success the shaft is finished, not even needing emery cloth for a polish. The time for turning out the finished shaft may be anywhere from twelve to sixteen hours.

SCALE.

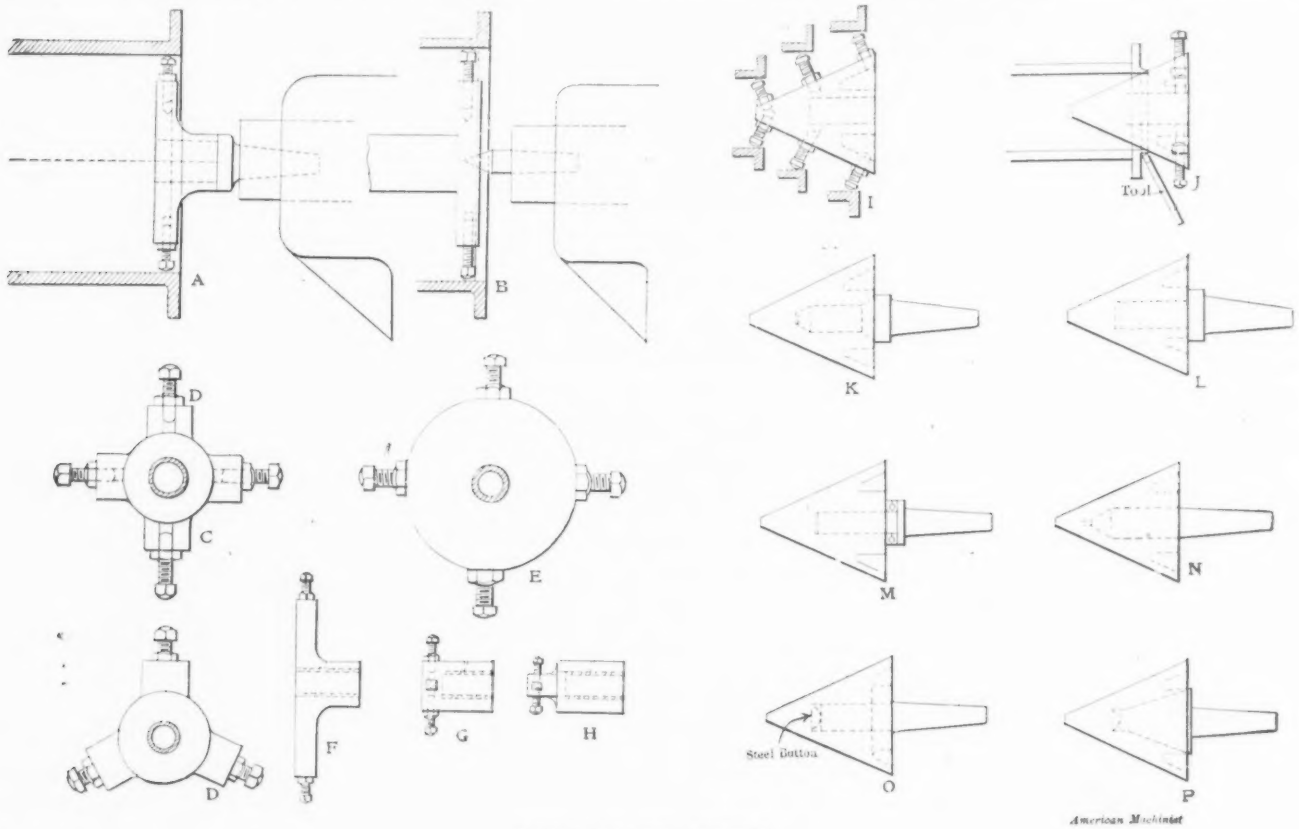
Spider and Pipe Centers.

In the sketches *A* shows a new spider center which is quite different from the old style *B* that requires, as shown, a block of wood against it to keep it from shoving in or twisting sideways when the center is pressed against it, or when a heavy cut is started.

This improved center will stand a heavier cut and can be set quicker than the other style. If the outside is turned true with the hole the job can be set in short order. *C*, *D* and *E* show end views of different forms of this center; and *F*, *G* and *H* are different sizes with bronze bushings in the interior. At *I* is illustrated the manner in which a common cone center can be turned into a spider center by drilling three rows of holes and putting in set-screws and jam-nuts, only one set of screws being needed, as they can be used in either series of holes. A spider center allows room for the tool to clear when facing off the end of a flange, but a cone center does not. When the tool gets down to the center, as at *J*, it leaves a shoulder which must be turned off with a pointed tool.

K is a center with a cone bearing at each end of the hole which keeps free from play even if it does wear. Center *L* is less work to make, but does not turn around when a heavy cut is taken; hence a ball-thrust bearing should be used as at *M* for heavy work. Center *N* works well in a heavy cut and is easily made. Center *O* is less work to make than any of the others and also works well with heavy work.

MORTIMER PARKER.



SPIDER AND PIPE CENTERS.

Shop Dining Rooms, Etc.

"We have a nice dining-room and reading-room, nice lockers, and a wash-room, and I am going to know why some of these fellows go out with dirty faces, carry their coats into the shop and don't use the dining-room, or I shall get rid of a few for an example," said the superintendent.

There can be no doubt that the majority of employers wish their men well; and the majority of men appreciate, in a way at least, any extra notice or consideration given them. If a man does not wish to dine or wash with certain company, I think that is his affair, and he should be let alone. If he doesn't like to use the same water in a trough where twenty or thirty other men are splashing, that's his business. If he can't afford to spread out as nice a lunch as most fellows, he will not feel embarrassed if he eats it alone. Then again he may not like to hear strong language or loud talking that may be used by some others in the dining-room.

As for going out with a dirty face, I think it is all right if he lives nearby, as he can clean and dress himself with more comfort and satisfaction at home. I saw a nice wash-room a few days ago which the men did not use at all. I found that it was because the place was like an iceberg and without warm water. The wire lockers were not nearly large enough for an overcoat to hang in, and the place was full of dust and dirt.

Men don't run from the shop at quitting time and come in at the last minute of starting time because they hate the shop;

they rather wish to be at home all they can.

Hard work in the shop doesn't hurt many; it's the confinement that kills. Therefore the more homelike the shop is the more contented the men will be. In many shops they blow the whistle five or ten minutes before the starting time, so that the men may be in place to start work on time. By the same token it might be a good scheme to blow the whistle two or three minutes before quitting time; then the men would not be hiding round getting ready five or ten minutes too soon, because they did not know the exact time.

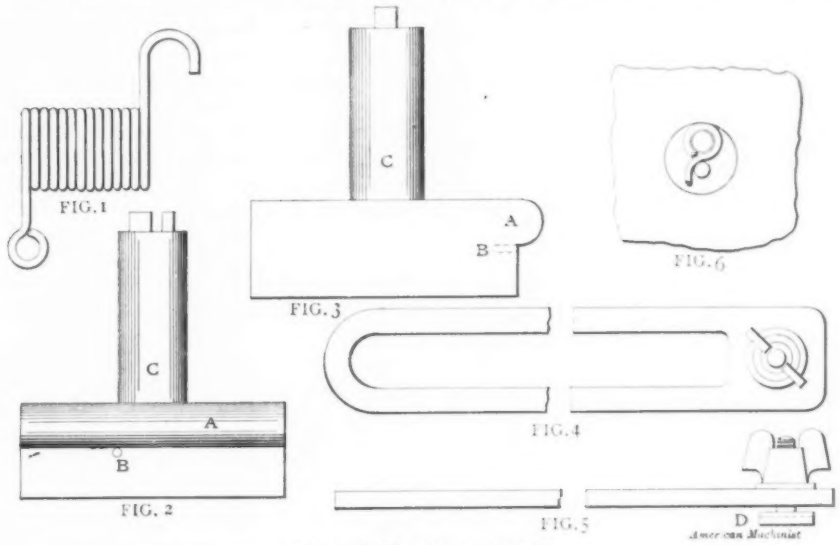
YURE ITSKYE.

Rig for Winding Coil Springs.

At page 1167, Vol. 27, a correspondent showed a device for winding coil springs. With it the hooked end of the spring has to be made after the spring has been wound. In the one here shown—which is exceedingly simple to use and very cheap to make—the bent or hooked end of the spring, Fig. 1, is made first. Fig. 2 shows the coiling block front elevation. Fig. 3 shows the end elevation, *A* showing the portion rounded off the same radius as the hooked end of the spring. The block is gripped in the vise and the wire, which is previously cut off to the required length, is inserted in the hole *B* and bent over the radius *A*. The slot in the coiling clamp—shown in plan at Fig. 4 and elevation at Fig. 5—is then put over the coiling pin *C* and the loose end of the wire is gripped—in the groove *D* cut in the bolt head—by the winged nut on top. The coiling clamp is then wound round the pin *C* the requisite number of times, keeping the wire tight and even, which is easily accomplished. The wing nut is then slackened and the spring will ease itself enough to allow the end to be pulled out of the hole. It is then taken off and the eye in the opposite end made round the two pegs shown at top of *C* in the manner shown at Fig. 6. It may require a pair of pliers to finish the end off satisfactorily. We have made large quantities of these springs from 16 gage wire, 20 inches in each spring with 8 coils, and have found that a boy can easily make 25 springs per hour without any trouble.

SPRING.

Birmingham, England.



RIG FOR COILING SPRINGS.

Wanted, the Best Arrangement of Tools in a Machinist's Tool Chest.

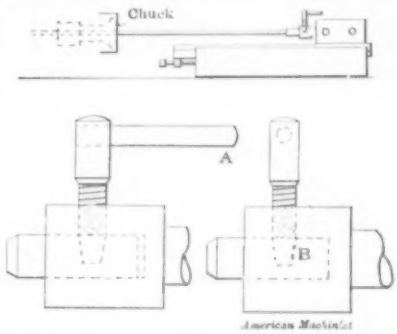
I am interested in the best possible arrangement of tools in a machinist's tool chest, so that everything may have its place, be compact and conduce to orderliness. Is there some person who will submit photographs of two or three drawers showing a pleasing arrangement of tools? I am of the opinion that many machinists will welcome such a presentation of this matter.

One of the most valuable additions to my kit of late is a small alcohol lamp and blowpipe. Its uses readily suggest themselves. I find that most of the small twist drills I have to use are soft and can be as readily filed sharp as ground. It is needless to say we have all struggled with them, and they won't do much drilling. I heat about 3-16 of the end with my lamp and blowpipe to a low red and quench in sperm oil. They retain their shape, and the cutting qualities are all that anyone can desire.

JOHN KOEHLER.

Stop for Cutting Off Stock in the Turret Lathe.

I am sending you a sketch of a cheap stop for use on a screw machine when cutting off stock. It is customary when cutting off stock, say from 1-16 to ½ inch diameter, if the pieces are long, to turn the turret slide around end for end, as shown in Fig. 1. In that way a much longer piece can be cut and the stop can be used. When the slide is in its normal position the turret can be moved away after locating each length to be cut, but not so when it is reversed. The result is that when the chuck is tightened on the stock, it is pushed forward, say, from two to ten thousandths of an inch (notwithstanding the fact that manufacturers claim that "their chuck" does not move forward when being tightened), which makes it jam against the stop, and causes trouble when it is cut off. Fig. 2 shows the stop of which I speak when ready for use, and Fig. 3 shows it after the work has been located and is being cut off. You just give the lever a quarter of a turn, or



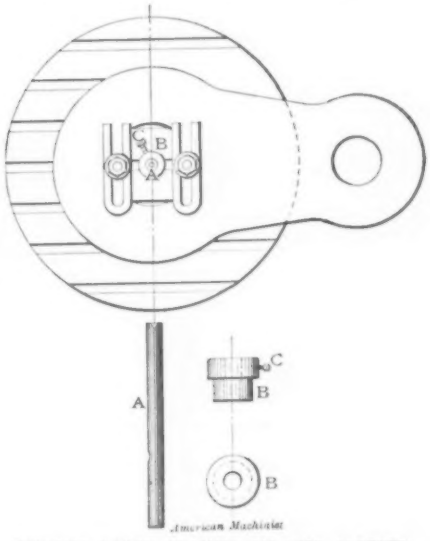
STOP FOR CUTTING OFF STOCK IN THE TURRET LATHE.

less, and the stop moves back and away from the end of the piece being cut, as shown at *B*. When the next piece is to be located, you just pull lever *A* back to its original position, and the stop comes back to exactly the same place.

CHARLES M. CARSON.

Setting Cranks on the Slotter.

The simple device here shown will save much valuable time when setting large forged-steel cranks on the slotter, previous to slotting around their edges. As they are often slotted before they are bored, the round center hole cannot act as a setting guide, and turning the table by hand is a very slow process to set the work true to the marking out. With this appliance the work can be set true without turning the table at all. *A* is a steel



SETTING LARGE CRANKS ON THE SLOTTER.

spindle, 1 inch diameter and about 18 inches long, turned parallel, with the centers left in. *B* is a gray-iron collar of the shape shown, bored out to receive *A*, and having the lower part on the outside turned to go into the center hole usually bored in the slotting machine table. *C* is a ⅜-inch set-screw for fastening *A* the required hight in *B*. When in use *B* is put in the center hole of the table, in which it should be a good fit. *A* is then adjusted level with the top of the crank to be operated upon, by the set-screw *C*. With a large pair of dividers the crank can easily be set central in a fraction of the time it requires when the table has to be turned around by hand.

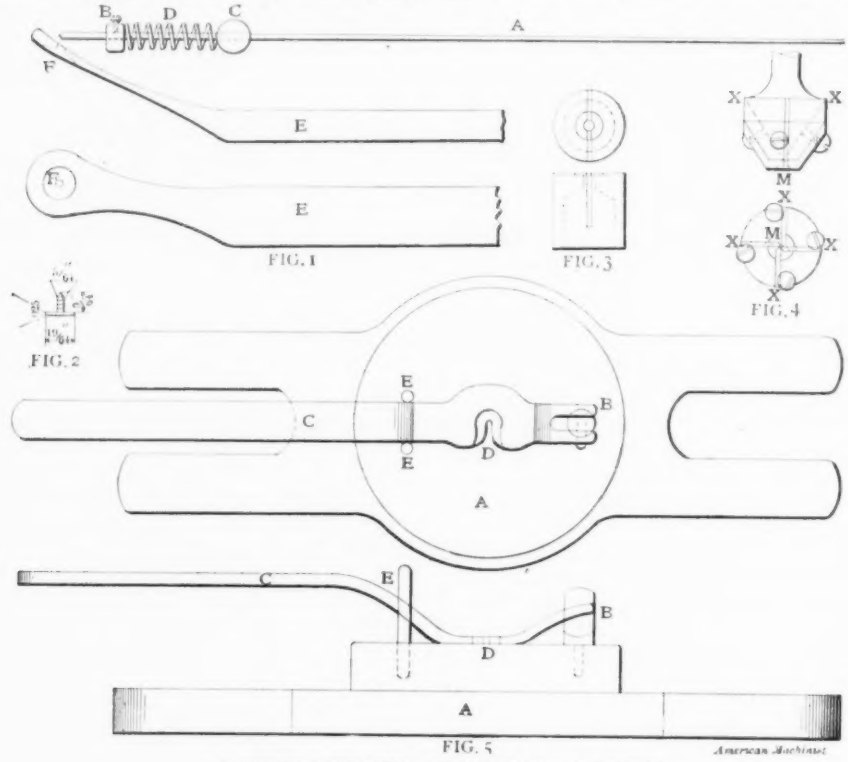
England. J. GREEN.

Center Indicator — Pointing Small Screws.

Fig. 1 represents a simple center indicator. It is very handy on account of being so light, and when placed in a chest or drawer it does not take up much room. *A* is the indicating rod, *B* is a collar held by a small screw, *C* is a round steel ball which swings in recess *F* in holder *E*. To center a piece in the lathe *E* is placed in the tool-post, the rod *A* is passed thru the small hole at *F*, letting the ball *C* rest in the recess. The carriage of the lathe is moved up until the ball *C* presses lightly on the spring *D*, which keeps the point of *A* in the center of the work. The neck of the holder *E* is forged out thin. The spring *D* is made of about No. 10 wire gage spring wire.

A short time ago we had a number of little screws, Fig. 2, to point. When bought they were square on the end, which made it very awkward to insert them, and they had to be pointed in some manner. At first we tried it with the split holder Fig. 3. This was held in a chuck in the speed lathe. It was recessed to hold the head of the screw. To use the holder the chuck was tightened and it, being split, tightened on the head of the screw. The boy then filed a point on the screw. This did not give satisfaction. The head was so uneven that it was difficult to get them to run true enough to file.

The foreman then had the holder and tool made as shown in Fig. 5. *A* is a convenient die block that was at hand, *B* is a stud screwed into *A* on which lever *C* works, *D* is a slot to admit the screw. *C* is curved as shown to allow the point of the forming tool, Fig. 4, to get close to the work, *E E* are two pins which guide *C*. The tool, Fig. 4, is made with four cutters which are held in place by small machine screws. When these cutters were first put in place the tool was trued up in the lathe, and the right angle was made in the blades at *M*, so that when they were taken out and backed off, and put in place again they would cut the proper angle on the screw point. To point the screws: The forming tool is held in the chuck on the sensitive drill. The holder *A* is clamped on the table in a proper position, so that when a screw is placed in slot *D* it will come in line with *M*. The boy raises the lever *C* slightly and passes the screw under and in slot *D* up to the shoulder. Then by holding down on the lever with one hand and bringing the tool down with the other, sufficient to form the top, the screw is finished. Raising the lever slightly, the screw is slipped out and another is put in.



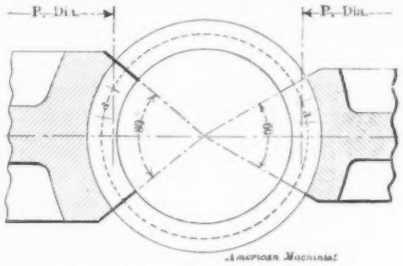
A CENTER INDICATOR—POINTING SMALL SCREWS.

The screws being light and small, it did not require much pressure on *C* to hold them. As we did not have a very great quantity of screws, it did not warrant a more elaborate rig. As it was, this did them in good time and was simply constructed.

PEDRO.

Diameter of Pitch Circles of Worm Gears.

There have been published in the technical periodicals many articles more or less learned about worm gears. In most



PITCH DIAMETER OF WORM GEARS.

of them the final outcome would seem to be correct enough, altho a good deal of ground was gone over in getting at it.

There may be readers who would be interested in a shorter method of determining the diameter of the pitch circle necessary for good work, and also in the information of how this method works out in practise. I used the following method for years and have found it good as well as quick, and easy to remember.

The sketch will illustrate the method. Ordinarily the contact of the teeth of the worm-wheel with the thread of the worm is embraced within an angle of 60 degrees. It may, of course, be more or less, according to circumstances, but practically ought not to be less than 45, or more than 80 degrees. In laying out a worm and worm gear by this method, draw the circles representing the top, bottom and pitch line of the worm. Lay off the angle, 60 degrees, enclosing the contact of the worm and the teeth of the worm gear. Divide the distance, on the pitch line, from the center line to the enclosing angle line into three equal parts, as at *a*. Thru the outer of the dividing points draw a line parallel with the worm-wheel shaft. This will determine the diameter of the pitch circle of the worm gear and from it the calculation of the circumference is made, as it is still customary to use the circumferential pitch for worm gears. A worm gear with an enclosing angle of 80 degrees is also shown, by which it will be seen that a considerable difference in the diameter of the pitch circle will be necessary when the angle is changed.

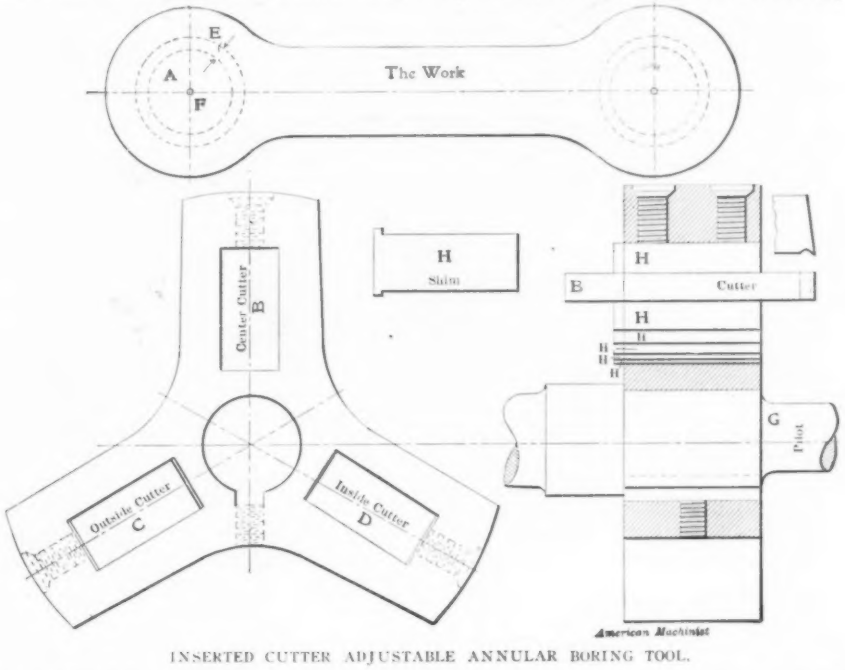
As to the practical value of this simple method it may be said that I designed a boring machine capable of boring 3-inch holes in 50-point carbon steel, in which a 9-inch worm gear was located on the shaft carrying a 2½-inch steel pinion working into a rack and operating the feed. The worm-wheel was of gray iron with an 80-

degree enclosing angle. The machine was built over seven years ago and the worm-wheel is apparently as good as ever, and whatever marks of wear show on the teeth indicate that the contact was quite correct. The worm is of 40-point carbon steel. The angle of the sides of the thread is 15 degrees, as usual. It is no doubt probable that a bronze worm gear would have been preferable, but the gray-iron one has done excellently well and is still doing good service. OSCAR E. PERRIGO.

New Haven, Conn.

An Inserted-Cutter Adjustable Annular Boring Tool.

In our line of work we had a great number of rods which were forged solid, about 3 inches thick, and each end had to be bored, the diameter of the bore ranging from 3 to 5 inches. The old way of drilling a circle of small holes to cut out the center blank *A* proved rather costly, hence the roughing head here shown. The body is made of soft steel, carrying three ⅜x¾-inch self-hardening steel cutters, each set at a different cutting angle. The center cutter *B* is set parallel to the vertical center line; cutter *C* is slanted slightly outward and cutter *D* inward. The three ⅜-inch cutters thus set, cut out the center blank *A*, cutting a groove about ½ inch wide, as shown at *E*. Central holes



INSERTED CUTTER ADJUSTABLE ANNULAR BORING TOOL.

F are drilled from the layout of a size to suit the pilot *G* on the arbor. This head will bore diameters varying from 2 to 5 inches by manipulating the shims *H*.

TURBINE.

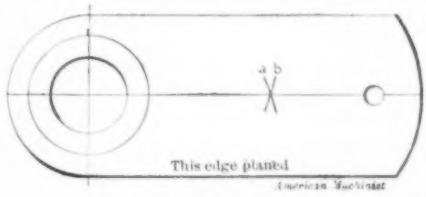
Uncertain Action of Steel in Hardening.

At page 162, under the heading "Uncertain Action of Steel in Hardening," your correspondent states that he had a die to harden having a 3¼-inch round hole, and that after hardening it he found the hole to be 3-128 inch larger at the top than at the bottom. He states that he had an even heat on it, but he does not state one of the important things, which is, how he dipped it in the bath.

Several reasons might be suggested why the die changed so, but the most probable one can perhaps be best understood by the following illustration. Let us assume that we have a round piece of steel, 3¼ inches inside diameter, 5¼ inches outside diameter and about 3 inches long. It is required to shrink it in diameter ⅛ inch or more, by a few successive heatings and dippings, which can easily be done. Let us assume that it is a cutting die ring, and that we heat it to the same heat as your correspondent did his die, nice and evenly. When properly heated we dip it endwise, cutting edge first to a shallow depth in the bath, say about ⅜ inch or so; the remaining 2½ inches we submerge only as fast as the action of the cooling bath blackens the steel. Then when it is completely submerged and cooled and taken out it will be found that the front end, the end submerged first, will be larger in diameter than the other end. The reason why is this: When the steel ring is heated, the whole ring expands and increases in diameter. But the steel itself expands upon itself, not alone outwardly, but inwardly, toward the center of the ring as well. Then when the first end is dipped in the bath that end immediately cools and contracts very quickly. It also immediately exerts an influence or pull on the remaining 2½ inches above the water, in an effort to bring the portions in lines parallel with the axis into line with their adjacent parts already submerged. This it accomplishes (and it must be remembered that the portion still above water, being heated, is still thicker than the submerged end), and the remaining portion, being submerged only as fast as the cooling action of the bath turns it black just above the water line, gives it a longer time in which to contract, with the result that the part dipped slowly will have a chance to shrink to a smaller diameter than the cutting end which we dipped so quickly. Hence I deduce that in your correspondent's case he dipped the cutting edge to a shallow depth quickly and the remaining portion very slowly, thus giving the cutting edge much less time to shrink than the part that followed, with the result that the cutting end, or the top of the hole, was larger in diameter than the bottom. R. B. BOONE.

Setting Crank Centers.

I do not like Mortimer Parker's way of setting crank centers at page 158. If he



SETTING CRANK CENTERS.

will put his two crank centers, or blind dogs, as some call them, together on a mandrel and plane or mill one edge and then lay out the center for the pin, so that a line thru the pin center and the shaft center will be parallel with the planed edge, he will find he has a more accurate and a much quicker way of setting his crank centers. Slip on the blind dogs, lay them on the level surface plate with the planed edge resting on the plate, level up the crank, set up the screws, and the job is done. To get the pin center in line with the shaft center and parallel with the planed edge while boring the hole, lay out a circle as in the sketch, draw a line at right angles to the planed edge thru or near the center. Then with a pair of dividers from the points where this line crosses the circle lay off arcs *a* and *b*, draw a line thru the point where these arcs cross parallel to the planed edge.

W. A. BRIGHT.

John A. McDonald, M. Am. Soc. C. E., Chief Engineer of the Russian-American Steel Company's works at Mariopol, Siberia, was shot and killed by a Russian colonel of engineers about two months ago, because he refused to permit certain material to be taken away from the works without being receipted for. Mr. McDonald was formerly in the employ of the Carnegie Steel Company, at Pittsburg. Charles Francis, M. Am. Soc. C. E., also in the employ of the same company, was imprisoned but was later released through the intervention of the American Ambassador, and has since returned to the United States.—*Engineering News.*

Vertical Spindle Milling Machine With Constant Speed Drive.

The accompanying engravings illustrate a new machine which the Brown & Sharpe Manufacturing Company has added to its line of vertical spindle millers and in which is incorporated a constant speed drive arranged on somewhat similar lines to that employed in connection with the universal miller described at page 1481, Vol. 26. As noted at that time, this feature, embodying a constant-speed belt and driving shaft, overcomes the well-known defects of the cone pulley as a spindle-driving medium and the disadvantages of a variable-speed spindle as a driver for the feed. Fig 1 gives an excellent idea of the appearance of the machine, and brings out—in conjunction with Fig. 2—the neat yet rigid design of the entire tool, the location of speed and feed gear boxes and the convenient arrangement of hand wheels, handles, etc., controlling its various movements. Fig. 3 shows the head and spindle: the latter is of crucible steel, with large bearings that are accurately ground and run in bronze boxes, and the lower box is provided with means of compensation for wear. The lower end is threaded to receive a chuck or large cutter, has a No. 11 taper hole and is milled across to lock arbors or collets that have a clutch collar. The drawing-in bolt passes up thru a 13-16 inch hole in the spindle. The spindle is back geared in the ratio of 4.97 to 1, and is driven by a Renold silent chain from the vertical shaft at the rear, this shaft being connected by bevel gears, as shown in Fig. 4, with the driving mechanism at the rear of the column.

The drive is taken from a countershaft or a constant-speed motor by the plain pulley, which is 14 inches diameter, takes a 3½-inch belt and which with its shaft is designed to run at about 310 turns per minute. Between the constant-speed shaft and the one geared to the vertical shaft the gear box carries, as shown in the sectional view in Fig. 4, an intermediate shaft upon which is placed a cone of four gears. An idler, carried in the manner indicated in the end view, connects this gear nest with the long pinion on the driving shaft below, and on the upper shaft in the box are two loose gears which remain in mesh with the gear cone, and either of which may be clutched at will to the shaft. The idler is controlled by the lever and knob shown below the speed plate at the front of the gear box, and to change the speed it is necessary only to unlatch the lever and move it down as far as it will go, then move the index slide under the speed plate until it is opposite the column on the plate corresponding to the required speed; the lever is then moved up, the locking pin engages the correct hole and the gears will be in proper mesh. The crank handle over the plate controls the two clutch gears on the bevel gear shaft at the top of the speed box, and thus gives two series of speeds, one fast and one slow. The spindle speeds obtained thru the gear box and the back gears are sixteen in number, and range in geometrical progression from 17 to 354 turns per minute, the gearing ratios ranging from 1 to 1 up to 18 to 1 for large cutters.

The feed mechanism is located below the speed box, as shown in Fig. 1, and the positive drive is direct from the machine pulley shaft by chain and sprocket wheels and, as this shaft runs at a constant speed, it is possible to obtain the correct feeds in relation to the spindle speeds in inches per minute. This method of driving gives a table feed that is independent of the spindle speed and also a fixed rate of feed, in inches per minute, for all diameters of cutters within the capacity of the machine, and the index plate shows the rate of feed in inches per minute.

The feed box construction is represented in Fig. 5 (tho the feed plate there shown happens to be for a machine with a different range of feeds) and, as will be seen, it is much like the speed box just described. The pinion shaft, driven thru chain and sprockets from the main shaft above, is located in the rear of the box and drives thru an idler a cone of six gears which actuate the shaft in front, thru the double gear mounted thereon. This shaft has at its outer end the joint for driving the telescopic shaft for the table feed, and also carries a small sprocket which by means of a chain feeds the spindle head.

The feeds vary in geometrical progression from 1½ to 17 inches per minute, giving for small mills .004 to .048 inch, and for large mills .088 to 1.000 inch per turn of spindle. To change the feed, the locking pin of the lever shown at the right of the feed case is withdrawn and the lever moved up as far as possible to lift the idler inside; the index slide underneath the feed table is then moved along until opposite the required column in the feed table; the lever is then moved down and the locking pin will drop into the proper hole. The short lever at the bottom of the case shifts the double gear inside and gives two series of feeds, one fast and one slow. The position of the levers for each feed is plainly shown by the feed table.

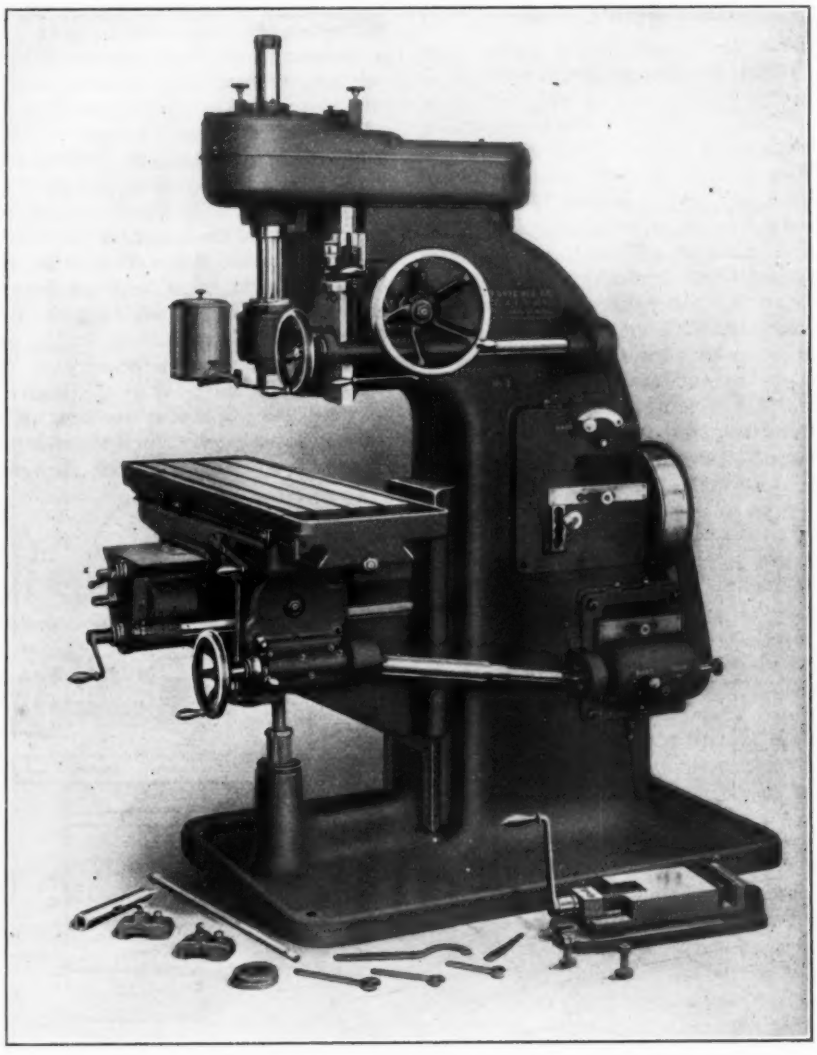


FIG. 1. VERTICAL SPINDLE MILLING MACHINE WITH CONSTANT SPEED DRIVE.

The table feeds are automatic in either direction and can be automatically released at any point and the table then remains locked in position. The power cross feed or the power vertical feed can be used with the table feed locked and when the feeds are in this position, the table can be indexed by hand.

The automatic, longitudinal and transverse feeds for the table are respectively 34 and 13½ inches and the automatic vertical feed for the knee 15 inches, which, with the 8-inch movement of the spindle head, gives a total vertical range of movement of 23 inches. The table is 50x14⅜ inches, has a working surface inside of oil pans and channels 42 inches long by 12 inches wide, with three ⅝-inch T-slots, and has a quick return obtained thru a coarse pitch screw operated by disengaging the feed worm and using the crank shown on the face of the knee. The hand-wheel at the right of the machine connects with the worm and worm-wheel and gives a slow and powerful hand feed in either direction. Ball thrusts are provided for the feed worm and elevating screw, and the feed screw is not splined, thus prolonging the life and original accuracy of both screw and nut.

The knee is of box form with ample bearing surfaces on the column face and under the saddle. It has a vertical adjustment by means of a telescopic screw, which does not extend below the base; and sliding covers protect feed screws and gears. Dials adjusted without wrench or screwdriver and graduated to read to thousandths of an inch indicate the longitudinal, transverse and vertical movements of table and the vertical movement of the spindle head.

The spindle head has, in addition to the automatic movement of 8 inches, a fine hand feed and a quick return. The automatic feed is convenient for drilling work already in position for milling, and is automatically released at any point. A micrometer stop on the head forms a convenient means for controlling the movement. The head is counterbalanced by weights inside of the column, as shown in Fig. 3; the feed mechanism is arranged as in Fig. 6, which shows clearly the chain and sprocket drive for the worm shaft and the levers, clutches and hand-wheels for the power and hand feeds and the quick return. The distance from the center of the spindle to the column is 18 inches, and the greatest distance between the spindle end and the table face is 23 inches.

The machine has finished pads at the rear for mounting a motor; is furnished with the equipment shown in the photograph and with a countershaft carrying two 14-inch friction pulleys for 4-inch belts, and may be supplied when required with a circular milling attachment. The net weight is about 4,800 pounds.

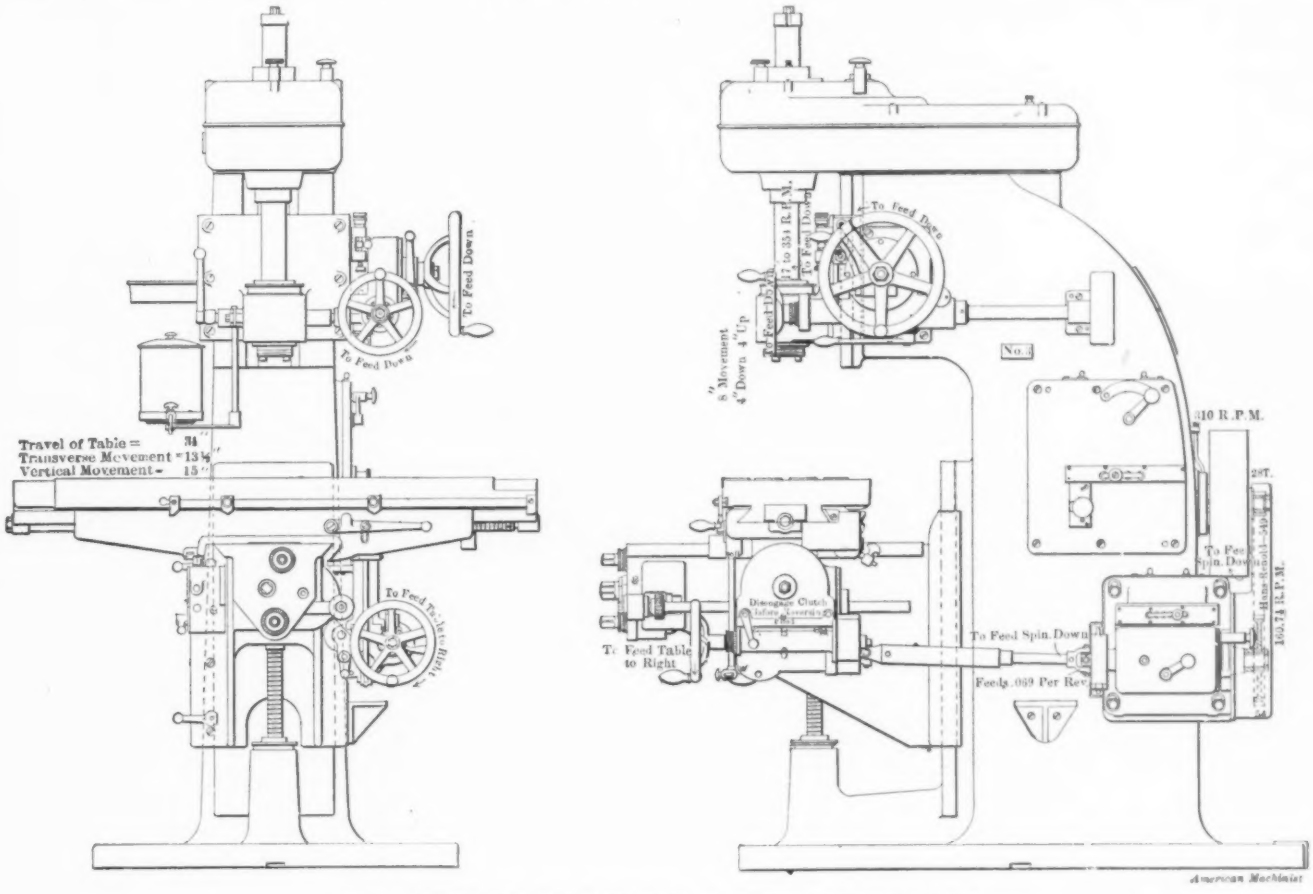


FIG. 2. FRONT AND END ELEVATIONS OF VERTICAL SPINDLE MILLER.

Technical Education.

BY AN INSTRUCTOR.

Leicester Allen's article at page 152 seems to me to give by all odds the best review of the relation of technical education to practical affairs that has so far appeared. However, there are at least two points which he has not, to my mind, fully covered.

Contact with quite a number of technical students and graduates at various stages of their careers has impressed me with the idea that neither they nor their parents fully understood while they were in school just what they could expect the school to do for them. Contact with instructors in some of these schools has convinced me also that they in turn do not fully understand the possible relation of their instructions to the future work of students. Both sides seem to mistake the shadow for the substance, the foundation for the complete structure.

Every reader will undoubtedly be able to recall specific instances where boys have been sent to technical schools without any regard whatever to their own natural inclinations. As if these schools could take any kind of raw material and turn out a finished product. More than that, boys go to these schools under the impression, fostered by their parents, that they will come out competent to hold down a two- or a three-thousand-dollar engineering job the

day after commencement. A cursory glance at the catalogs of some of these schools will carry out this impression, tho a more careful reading will fail to justify it.

RAW MATERIAL OF THE SCHOOLS.

If any one school would come out with a distinct statement that its efforts were devoted solely to laying a foundation on which the student might later build by himself and would say that he could not reasonably expect to make a visible mark in the world for several years after graduating, I believe that that school would in the end prosper for its frankness. It might lose a number of students now sent to such schools under the misapprehension stated above, but if it sent out a statement of its facilities for instruction written up in a manner calculated to interest practical men it would bring out a large number of the sons of such men, who would already be prepared by birth and environment to take a technical course and to profit by it. It must be evident to anyone that a man, in order to achieve success in engineering, must be to a considerable extent born with a predisposition for it. We accept as a fact that a sculptor is born, not made, yet a sculptor only has to make an inanimate, immobile reproduction of the image in his mind, while the engineer is constantly called on to make moving machinery whose parts shall act according to a preconceived idea without clashing, all of which must be carried in his mind before they can even be laid out on paper. Unless a man has an imagination such that he can readily form conceptions of motion and form in his mind the technical school can do little for him.

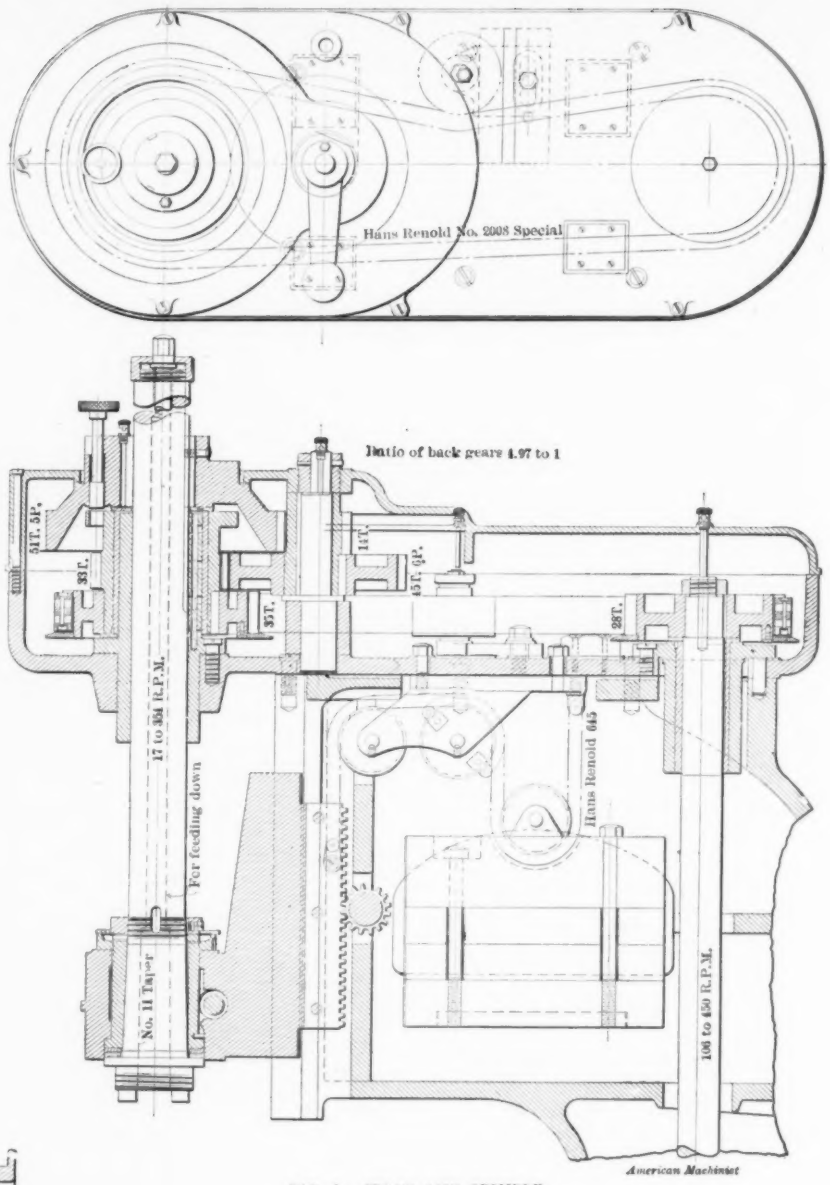


FIG. 3. HEAD AND SPINDLE.

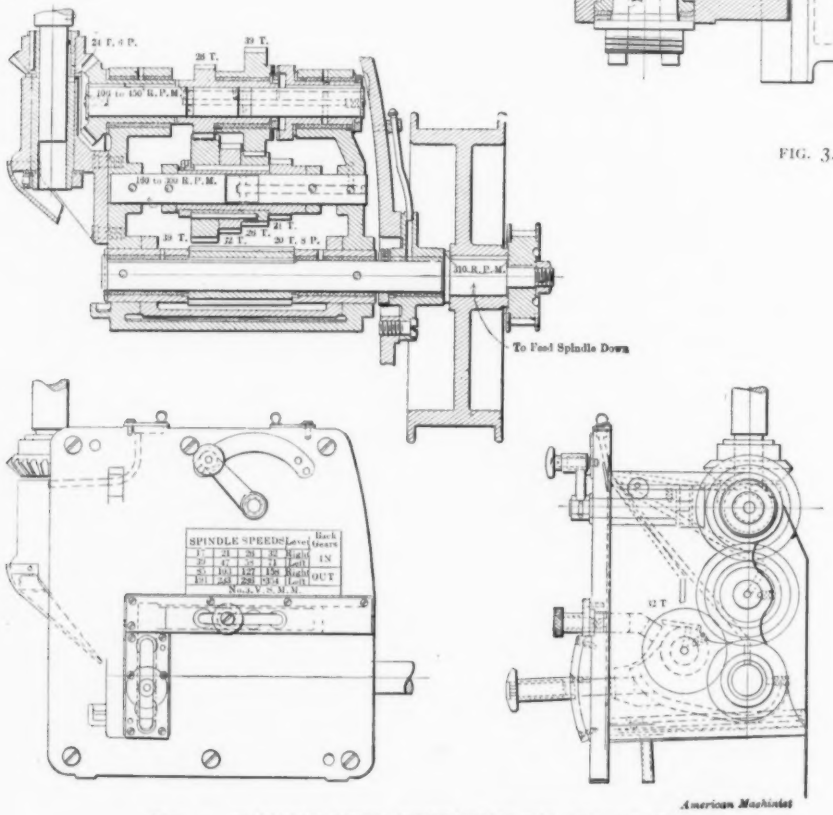


FIG. 4. VARIABLE SPEED MECHANISM FOR DRIVING SPINDLE.

ENGINEERING OF MATERIALS AND OF MEN.

Another thing that should be distinctly understood is that the engineering of materials does not lead to the rapid acquirement of wealth. A man who would be an engineer must be content to be a plodder so far as wealth is concerned. The greatest wealth is gained by those who can engineer men, and for this a technical training really unfits men. Familiarity with material and its handling seems to take away from men the desire for familiarity with men—to decrease the social longing. So few men can possibly succeed in this other form of engineering that unless one has unlimited faith in his adaptability for it he had best be content with some more humble but more stable branch of engineering.

INSUFFICIENT TIME ALLOWED FOR STUDY AND PRACTISE.

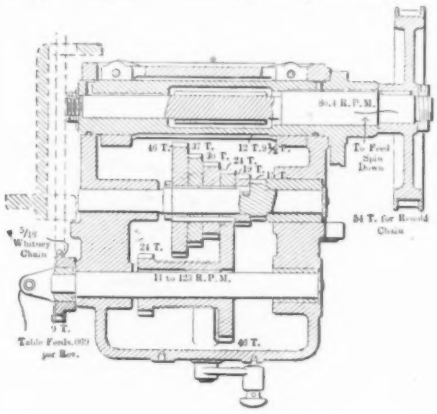
The second point is in connection with the engagement of practising engineers as part time teachers.

A brief connection with technical teach-

ing has convinced me that it is not possible to advance students far along any one engineering line in the painfully short time which present curriculums allow. When we consider that a technical student takes up in a four years' course anywhere from thirty to forty studies and that his working time is only thirty-odd weeks out of fifty-two each year, giving an average of, say, 200 hours per study, can we wonder if the average practical man who occasionally drifts into teaching is easily discouraged?

What will twenty 10-hour days do toward making a draftsman? And yet we have to take men barely knowing how to handle a pen, and with only the principles of projection and in less than twenty days' actual work give them all the knowledge of the subject that they will have before they are turned out on the world. They go into shops to earn their way as draftsmen and because they cannot at the start hold their own with experienced men they (and we) are condemned.

No school that the writer knows of gives the equivalent of over three months of shop practise. What would you shop men expect of an apprentice in three months? Your apprentices in three years do not acquire sufficient skill so that you dare to put them on work of any difficulty, and you certainly don't give them journeymen's pay.



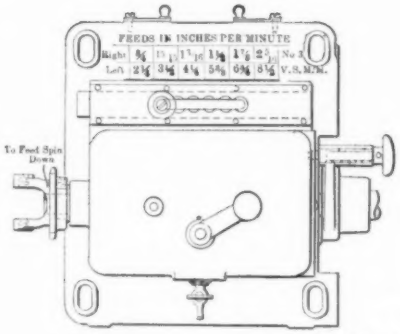
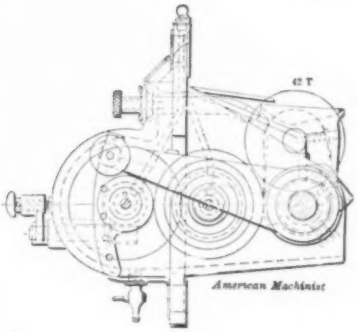


FIG. 5. FEED BOX.



With this limited time it is obvious that any attempt to lead a student into any original work will only leave him floundering beyond his depth.

If a man of any considerable ability is engaged to teach such men, he may create a good impression on them as to his own ability by soaring far above their heads, but such a man can seldom get down to the level of student intellect. The point where their understanding ceases is so far below his level that he cannot comprehend their difficulties. More than that, a man who has made his mark, say, as a designer of machinery, more often than not does a large part of his work by intuition based on a good memory for past successes and failures, but which he cannot transmit to students. To tell a student to do a thing because you know that it is the thing to do without giving him definite reasons is far from satisfactory and the practical man who attempts to teach finds at once that he must put his knowledge in some systematic form before he can expect the boys to assimilate it. Since so little time is available and so many things must be, not covered, but touched upon, the present plan of instruction is probably as good as can be had. With so little to be taught it becomes not so much a question of professional ability on the part of the instructor as of pedagogical ability, the ability to so arrange and explain a subject and to so enforce its mastery that the student can be compelled to swallow it whether he digests it or not. Seldom are any of the subjects carried to the point where the student is encouraged or allowed to use independent thought, and it is only at that point that the practical man could take up the work and find in it any satisfaction.

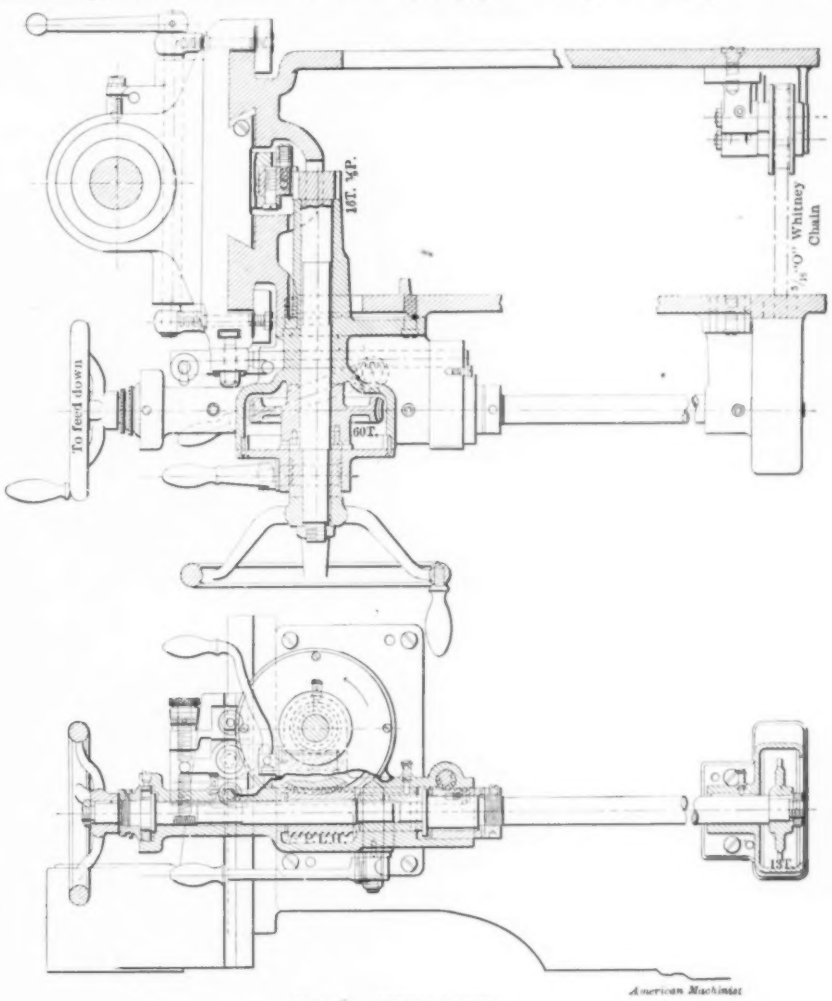


FIG. 6. SPINDLE FEED.

GREATER CONCENTRATION NEEDED.

The solution would appear to be found in the adage that "what is worth doing at all is worth doing well." If any of these subjects of instruction are worth doing at all they are worth going into minutely. Choose those of most value both from an educational and practical point of view. Cut off the others and cut to the quick. Go into the remaining studies thoroughly and deeply, with the students doing individual work. People will say that we are losing in mental training and that the

course is narrow. There is more real mental discipline and broadening of the mind to be obtained from the deep, thorough study of one subject than from the superficial reading of a dozen.

36-Inch Vertical Turret Lathe.

The illustrations show a new machine which has been brought out by the Bullard Machine Tool Company, Bridgeport, Conn. The capacity of the machine is 36 inches diameter by 24 inches in hight. The table—driven by an internal spur gear nearly as large as the table itself—has fifteen changes of speeds in geometrical progression. These changes are instantly obtainable by means of a lever, thru a speed box. The machine is driven by a single-speed driving pulley. The table may be stopped by means of a brake, which is operated by lifting the speed lever. The cross and side rails are a unit and have a vertical adjustment of 12 inches by power. There is one vertical head and one side head, which are entirely independent of each other. Both heads may be operated jointly on work of small size without interference. The vertical head will face 36 inches and has a vertical or angular traverse of 26 inches. It may be set at an angle of 45 degrees either way. The turret has five faces which are square with the table, the inscribed circle being 10 inches diameter. The holes in the turret are 2½ inches diameter. The faces are provided with tapped holes also, so that special tool-holders may be attached. The adjustments for wear on the turret slides are by means of tapered wedges. The side head has a vertical adjustment of 28 inches and a horizontal travel of 15 inches. It may be set at an angle of 40 degrees either side of horizontal. The machine can also be supplied without the side head, as in Fig. 2, in which form it has a capacity of 41 inches diameter. The feed works for each head are entirely independent. Their position is shown in Figs. 1, 2, 3 and 4. There are eight changes of feed for the heads, ranging from 1-96 inch to ½ inch in all directions. These changes are obtained by turning a star-wheel; the amount of feed per revolution is indicated on a direct-reading index plate on each feed box. Change from vertical to cross feed, or *vice versa*, is obtained by engaging a drop worm with worm gears on the end of the feed rods. A thread-cutting attachment, shown on top of the feed box in Fig. 4, may be applied at any time, but is extra. The machine is self-contained. It weighs 9,300 pounds, and occupies 65x70 inches floor space.

A good fireproof cement can be formed of iron filings 140 parts, hydraulic lime 20 parts, quartz sand 25 parts, sal-ammoniac 5 parts, and enough of vinegar to make a paste. A similar cement consists of iron filings 180 parts, lime 45 parts, and common salt 5 parts, converted into a paste with strong vinegar.

Prof. John E. Sweet.

During Professor Sweet's absence in Europe "his boys" may feel at liberty to do things they would not do if he were here to keep an eye on them, and so in the February number of *The Sibley Journal of Engineering* Prof. Albert W. Smith, the successor of Prof. Thurston as director of Sibley College, has an article about Prof. Sweet which we reprint as being likely to interest the many readers of our paper who in one sense or another regard themselves as among "Prof. Sweet's boys." Prof. Smith's article is as follows:

All who were students in Sibley College between the years 1873 and 1879 came under the influence of Prof. John E. Sweet. He was Director of Shops at that time; but while he taught the principles of machine construction, he did far more—he inspired his students with high ideals in machine design, and with a genuine enthusiasm for engineering.

Professor Sweet's distinguishing characteristic is straightforwardness. He designed the "Straight Line Engine," and this admirable design is a materialized expression of the designer's nature. If there is a straight path from effort to result there must be no swerving, but if there is need for turning none could turn in lines more graceful than he.

He is what may be called an "intuitive designer." The rest of us struggle with mathematical intricacies toward uncertain results, while he sees the end at first and wonders that we do not. A mathematician once asked him about something that he had proved by pages of equations. Professor said: "Suppose this—and that—, then the proposition is true, isn't it?" And it was true. But what are we going to do with our mathematics if things are to be done this way?

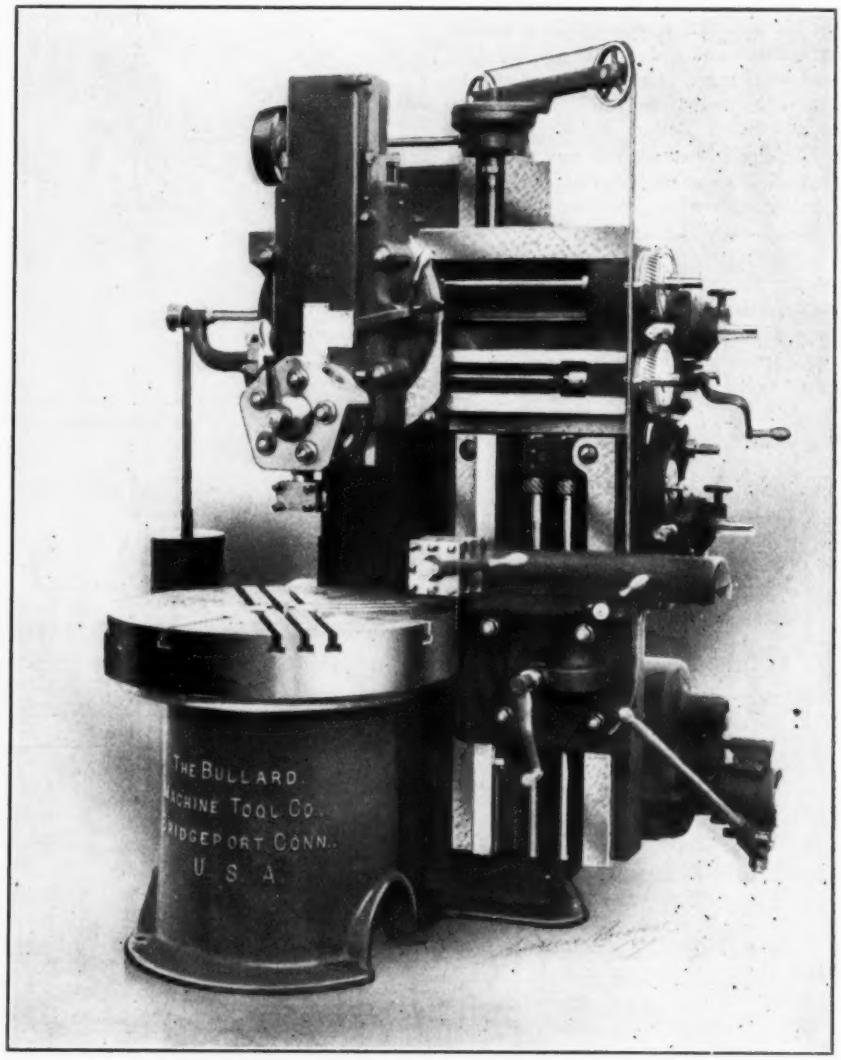


FIG. 1. 36-INCH VERTICAL TURRET LATHE.

In the "old days" the shop—there was but one—was in the first floor room in the west end of Sibley. One could go there any day and find Professor Sweet whittling a pattern or scraping a surface plate—for he always had work for his own hands—with a group of students standing around listening to a lecture that was not on the schedule. These lectures were among the best of our course. Or it would be an informal discussion. Some student had found an interesting unsolved question, and each student present would express his opinion and the fog would thick-

en till the question was entirely hidden. Then Professor would smile and shift the switch and turn clear light on the whole subject, and we would go away wondering how we had failed to see anything so simple.

It was characteristic of Professor Sweet that he introduced into the Sibley shop the making of scraped surface plates and straight-edges and of ground standard gages at a time when such auxiliaries to shop processes were considered unnecessary refinements. His love for truth has influenced all modern machine-shop practise.

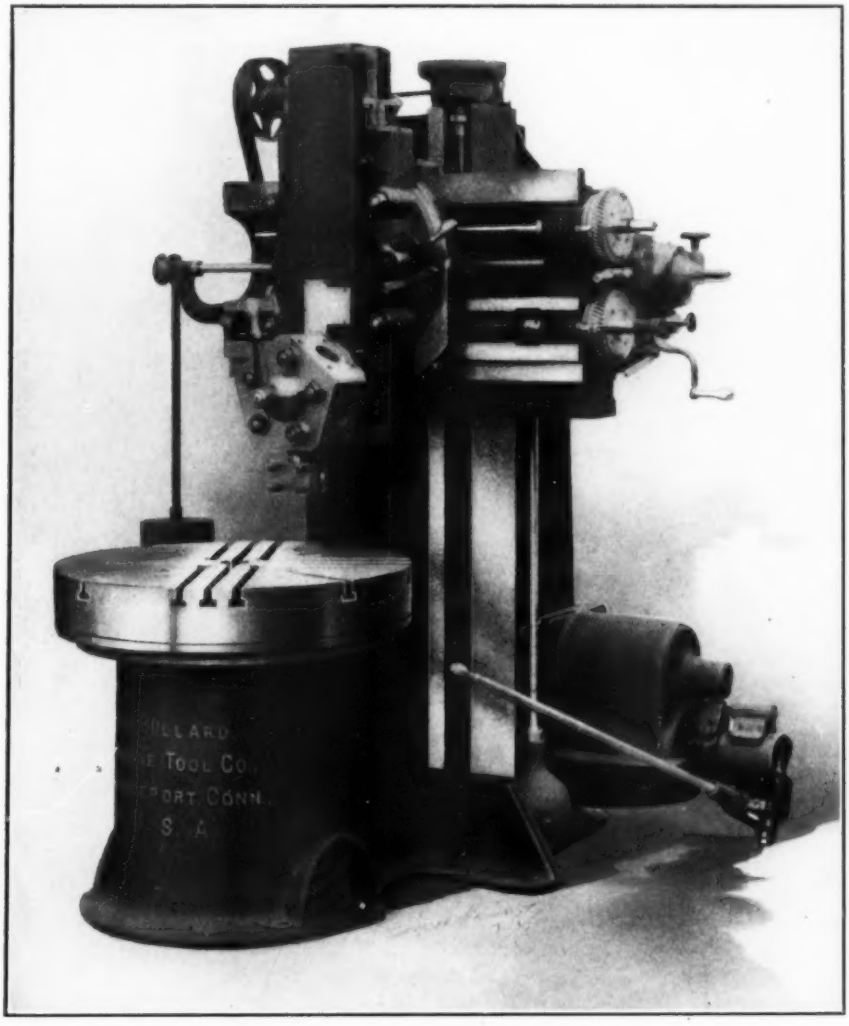


FIG. 2. SHOWING VERTICAL HEAD ONLY.

It would be natural that sound judgment should accompany Professor Sweet's other straightforward qualities. Once an inventor of the tangle-brain type showed him an invention of great ingenuity and complexity. Then he asked him what he thought of it. "Well," said he, "it seems to be a mighty good way to do a thing that doesn't need to be done."

Professor Sweet's influence on his associates is strong because of his personal qualities. His keen sense of humor makes it a rare privilege to hear him tell a story or to tell him one. His kindness and ready sympathy make it a rare privilege to have him for a friend.

In December, 1902, a group of "Prof. Sweet's boys" came together at a dinner in New York city to do honor to him who had influenced all their lives for good. The occasion proved so pleasant that it has become an annual event.

Professor Sweet's influence was strong in the development of Sibley College, for he guided it in early days toward the best ideals in mechanical engineering. His thought has modified modern machine design for its betterment and he stands among the most distinguished mechanical engineers of his time. But only we who have had the privilege of his friendship know the true greatness of the man.

The Fairbanks Company, Baltimore, Maryland, reports the loss by fire, on February 17, of all of its catalog files and price lists, and will be glad if all manufacturers of machinery, supplies, etc. will send to it at once, copies of their latest catalog and discount sheets. Firms in position to comply with this request will see the value and propriety of giving it immediate attention.

Metric System in Great Britain — Report of the Decimal Association.

An American manufacturer interested in the metric question sends us a copy of the recently issued report of the Decimal Association whose offices are in Oxford Court, Cannon street, London, E. C. This association numbers among its officers and members many very prominent manufacturers and engineers, and we understand favors the decimalization of British coinage, as well as British weights and measures. The report before us relates, however, exclusively to the efforts now being made for the general adoption of the metric system all over the world and is of course of interest to machine constructors regardless of their own attitude toward the subject. The report opens with a reference to pending British legislation on the subject as follows:

The Executive Committee have much pleasure in recording most satisfactory and encouraging progress toward the adoption of the metric system of weights and measures since the issue of the last report in October, 1903.

The growth of the popular feeling in favor of the change had been so marked that the Executive Committee gladly decided in October, 1903, to take advantage of an offer made by Lord Belhaven and Stenton to attempt the passage of a bill thru the House of Lords to render the metric weights and measures compulsory in this country. Lord Kelvin very kindly agreed to support the bill on its introduction.

. . . With the concurrence of His Majesty's Government, the bill was read a second time, and was referred to a Select Committee for consideration.

After revision, in committee, and the acceptance of certain amendments suggested by government departments, the bill was read the third time on May 17, and sent to the House of Commons.*

During the passage of the bill thru committee, Lord Belhaven and Stenton presented a great number of petitions which had been collected by the association in support of the measure. In his speech on the third reading he said:

"Then there is the great support the bill has received throughout the country, which is shown by the enormous number of petitions in its favor which have been sent in. The town, city and county councils which have presented petitions represent a population of over 8,000,000. Fifty chambers of commerce have petitioned, as well as forty-two trades unions, representing 300,000 members, sixty teachers' associations, the inspectors of weights and measures in eighty districts, and thirty retail trades associations. Several chambers of agricul-

* NOTE—It is important that this bill should not be confounded with the Weights and Measures Bill introduced by Mr. Bousfield in February, 1904, which contained a clause substituting Metric for Troy and Apothecaries' Weights. Mr. Bousfield's bill was an entirely independent one, and the abandonment of that clause in no way affected the bill in which the association is interested.

ture and farmers' associations have also petitioned, and I may add that the whole of Scotland, as represented by the Scottish Chamber of Agriculture and the Highland Society, is with us. The petitioners too, include a vast number of engineers and manufacturers of all sorts. I think these facts prove that there is a very strong feeling in the country in favor of the adoption of the metric system."

Simultaneously with the progress of the bill thru the Lords, the association was actively engaged in preparing the way in the House of Commons, and the views of every member of that chamber were sought. As the result of this special canvass it is very satisfactory to note that over 330 votes of M. P.'s were promised for the bill when it should reach the Commons. This affords a strong indication of the favorable prospects of the bill going thru that house as soon as an opportunity for debate can be secured.

Every effort will be made to carry the bill thru the Commons during the coming session of Parliament, and definite steps are now being taken with this object.

TRADES UNIONS.

The trades unions of the country, representing the working classes, have not in the least abated their interest in the question, nor in their determination to secure legislation. In addition to the petitions presented from trades unions to the House of Lords, it may be mentioned that at the Congress of Trades Unions held at Leeds, in September, 1904, where over 5,000,000 workingmen were represented, it was unanimously resolved to petition the House of Commons in favor of Lord Belhaven's bill which had then passed the House of Lords.

The Parliamentary Committee of the Trades Union Congress have since requested the Home Secretary to receive a deputation to express their views on the need for this reform.

The report then speaks of action taken by various Colonial authorities and representative bodies favoring the general adoption of the system and urging general cooperation. The New Zealand Parliament, for instance, having passed an act containing the following clause:

"It shall be lawful for the Governor at any time, by proclamation, to declare that from and after a date named in the proclamation, being not sooner than the first day of January, 1906, the Metric System, as described in the *Second* Schedule hereto, shall be the only system of weights and measures recognized for use in New Zealand and, thereafter, it shall not be lawful to use any weights and measures other than those described in the said *Second* Schedule."

Referring again to action taken by various representative bodies at home, the report says:

ACCOUNTANTS AND AUDITORS.

The Council of the Society of Accountants and Auditors in London passed, in November, 1903, a resolution in favor of the adoption of the metric system as the legal standard for the United Kingdom.

MEDICAL PROFESSION.

The medical profession has always viewed the efforts of the association with sympathy, and it may be well at this point to remind members of the association that in the latest issue of the *British Pharmacopoeia*, the equivalents for all prescriptions are given in terms of the metric system side by side with the English weights and measures.

GENERAL MEDICAL COUNCIL.

The association approached the General Medical Council, by memorial, in March last, praying for their support in favor of the bill then before the House of Lords, and it is agreeable to relate that the following resolution, which may be taken to fairly represent the attitude of the profession, was agreed to unanimously:

"That the President (with the Chairman of the Pharmacopœia Committee) be requested to inform the Lord President of the Privy Council that in the opinion of the Council it is desirable that after a sufficient period, to be fixed by law, the Metric System of Weights and Measures should become the one legal system for the preparation and dispensing of drugs and medicines; that the Council would view with favor the passing into law of a bill such as that now before Parliament entitled the 'Weights and Measures (Metric System) Bill,' and that in that event the Council would be prepared to take all necessary steps to give effect to the law by making the proper modifications in the *British Pharmacopoeia*."

The attitude of associations representing distinctive trades toward this question is no less significant.

SILK ASSOCIATION.

The Silk Association of Great Britain and Ireland, aiming (*inter alia*) at securing international uniformity in the numbering of the counts of yarns, and recognizing that it is impossible to establish such a uniform international count for yarns until there is a uniform standard system of weights and measures, believes that the adoption of the Metric System of Weights and Measures would be a great assistance to the silk industry. This society has rendered great help in promoting the objects of the Decimal Association.

Nor is the demand for reform confined to the professional and the manufacturing classes.

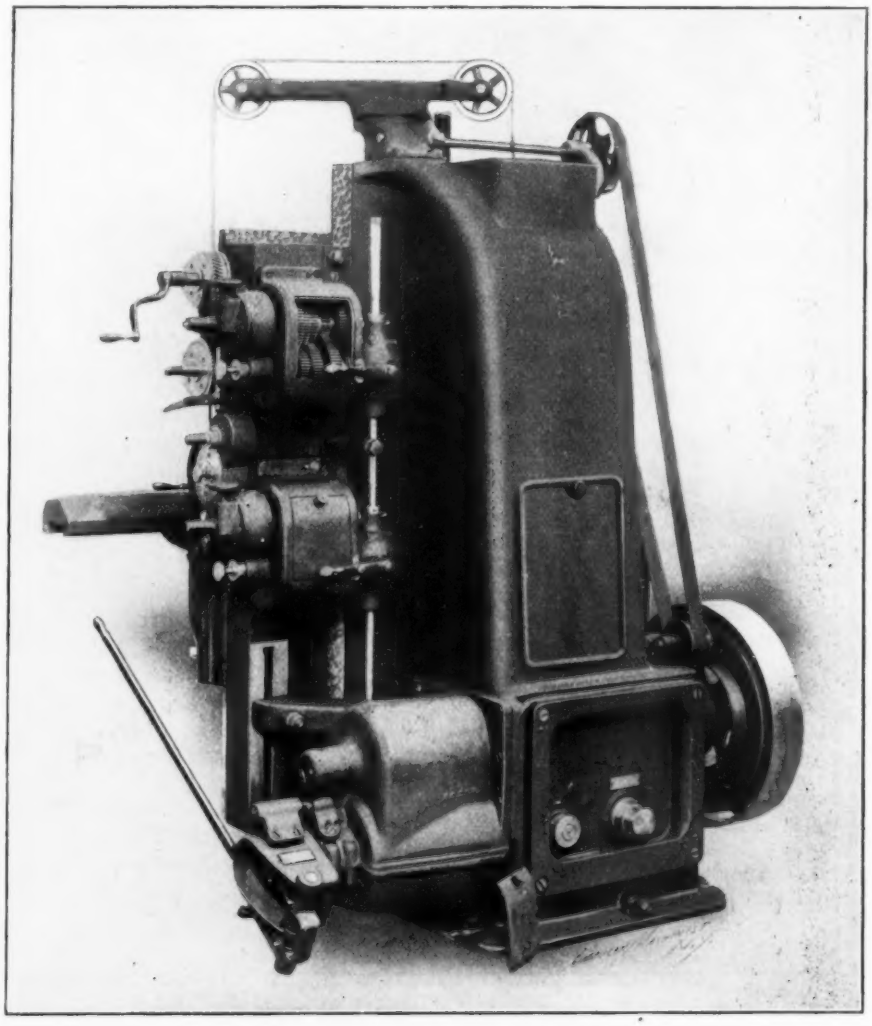


FIG. 3. REAR OF MACHINE, SHOWING FEED WORKS.

TRADE PROTECTION SOCIETIES.

The Association of Trade Protection Societies of the United Kingdom probably represents more thoroughly than any other organization the retailers of the country. It is therefore very instructive to record the continued, consistent, and cordial co-operation received from this association. Their attitude toward the aims of the Decimal Association is clearly displayed in the following resolutions passed at their general meeting held in May, 1904:

"That this association cordially supports the Metric Weights and Measures Bill now under consideration of the House of Lords, and trusts that it will receive its third reading in that Chamber, and that the Government, in view of the almost unanimous feeling in favor of the bill, will grant facilities for the measure to pass thru the Commons, and thus ensure the enactment this session of a most necessary and desirable reform. The Association further suggests that the following steps be taken at once to enable the Metric System to be introduced with the least dislocation of trade: (a) That all export merchants use the system. (b) That the Government issue all its specifications and orders in the terms of the system. (c) That the Board of Education insist that adequate instruction in the system be given in all elementary schools and institutes in receipt of public grants, and that the Inspectors of the Board be requested to examine as to the instruction afforded."

The last report issued by the Committee of this Association of Trade Protection Societies referred to the prospect of early legislation, and the members were urged to maintain their efforts to secure the passage of the bill.

ASSOCIATION OF CHAMBERS OF COMMERCE.

At the meeting of the Association of Chambers of Commerce, held in London in April, 1904, the question of the adoption of the metric weights and measures was one of the most prominent subjects discussed, and the following resolutions were carried by a large majority:

"That His Majesty's Government be respectfully urged to grant early facilities for the passage of the bill for the compulsory adoption of Metric Weights and Measures throughout the United Kingdom, to be introduced this session into both Houses of Parliament on behalf of the Decimal Association.

"That to facilitate the introduction of the Metric System, it is desirable that decimals should be taught in all elementary schools concurrently with simple arithmetic, and that the Executive Council be requested to bring the matter before the educational authorities."

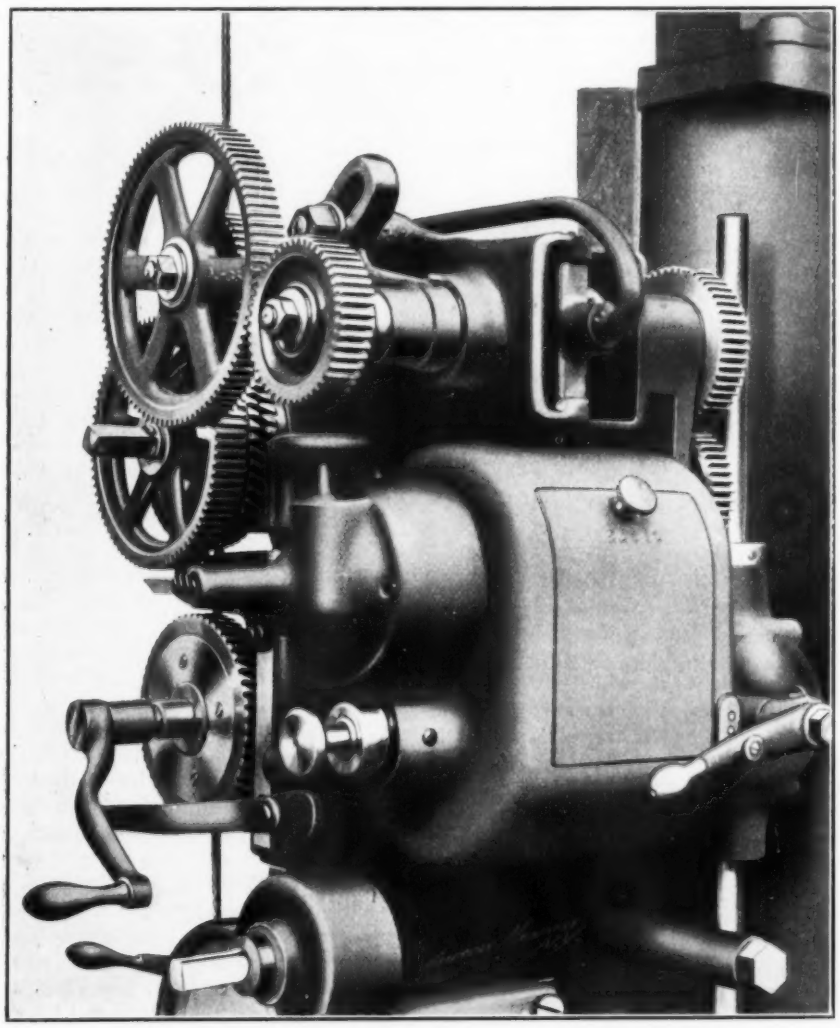


FIG. 4. SCREW CUTTING GEAR OVER FEED WORKS.

OPPOSITION.

After referring to the fund left by the will of Herbert Spencer to be used in circulating his pamphlet opposing the metric system and stating that it seemed to have had little effect and also that the association had prepared pamphlets answering it, the report says:

With regard to an association which has lately been formed having for its objects "the defence, standardizing and simplification of British weights and measures," it would perhaps be well here to recall the views of the Select Committee of the House of Commons on Weights and Measures of 1862. In their report they said:

"It would involve almost as much difficulty to create a special decimal system of our own as simply to adopt the metric decimal system in common with other nations, and if we did so create a special national system, we should, in all likelihood, *have to change it again in a few years into an international one.*"

USE IN TEXTILE WORK.

It is sometimes urged that the metric system is unsuitable for textiles. It should be sufficient to assert, on the authority of yarn merchants and the American Chamber of Commerce in Paris, that a universal count of yarns based on the metric system is growing in popularity and likely to become general throughout the world.

IN BUILDING MACHINERY.

A great point is also made as to the inconvenience and cost to engineers, but it is remarkable in face of this, that the majority of the leading engineering firms in this country are heartily supporting the efforts of the Decimal Association. The change from British to metric measures will involve no other expense than the supplying to the shop assistant convenient metric measures instead of yards, pounds, ounces, quarts, pints, etc., at present used; and in giving to the British workman a convenient metric substitute for his "two-foot rule." In an engineering workshop, all patterns, jigs and templets will remain unchanged. These, as at present used, are not approximations to feet and inches, which can be expressed simply either in eighths or tenths or sixteenths or thirty-seconds of an inch. They are at present practically expressed in decimals of an inch. When, as is frequently the case, accuracy to nearer than a hundredth of an inch is required, three or more places of decimals of an inch are needed for expression in figures. So much has this need been felt that a new name for a British measure, the "mil," has actually been adopted for the thousandth of an inch.

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Have Our Standards Been Destroyed?

The *Textile World Record*, which is supposed to know much more about yarns, picks, skeins, etc., than about refined methods of measuring or the exact reproduction or comparison of standards of length, rushes in where—that is to say, it evinces in its February number a determination to see to it that the Washington authorities shall be made to realize that they have been very remiss in the matter of the establishment and maintenance of standards; and, we judge, it has fears that, unless things are looked after much better than they have been by those who have charge of our standards, the precise length of a piece of yarn may become indeterminable without taking it to London to compare it with the good old "Bronze No. 1."

Not only has Congress been very remiss in looking after these matters, but, horror of horrors! our standards have, according to our Boston contemparary, been shipped by express to Buffalo and to St. Louis and back. As if this were not enough, these standards have, at these places, been stared at by "gaping crowds," and it ought to be evident to everybody that their value has been thereby utterly destroyed as standards and can be restored only by taking them to Europe for comparison.

We hope to quiet the agitated nerves of our esteemed contemporary by our assurance that its alarm has no foundation in fact. None of the standards now depended upon as a final reference has been sent by express to Buffalo or to St. Louis, nor have they been looked at by "gaping crowds" or crowds which do not gape. They have remained quietly sealed up in their proper places in the Bureau of Standards, and only discarded or superseded standards or models of standards have ever been taken anywhere for exhibition. The standards upon which we depend are guarded in Washington with the utmost care. None of them has ever been out of the immediate care of their proper custodians, and when taken abroad for verification, they have been constantly —day and night—in the personal care of men fully cognizant of their importance and observant of every possible precaution to prevent anything happening to them.

Of course all these things could have been very readily found out by our contemporary before publishing its editorial thunder, but that would have spoiled its opportunity for attempting to throw discredit upon a bureau which has displeased it in other ways by having men about who presume to hold opinions of their own, differing somewhat from those held by the editor of the *Textile World Record*.

INCOMMENSURABILITY OF METER AND YARD.

Our contemporary is also deeply incensed by the fact that our present standard yard measure is derived from a metric bar, which bar was made by the International Bureau of Standards at Paris, and regarding this it says: "Moreover, the verification of the yard by comparison with the meter . . . is but a pretense, because the yard is incommensurable with the decimal divisions of the meter."

Now, of course the fact is that the meter bar is used as a final reference standard in preference to the other and older standard bars because it is a better bar in many respects than any of the older ones. It is made of better material, which is disposed in a better form; all these points having been worked out much more thoroughly in preparation for the making of the international standard bars than they had ever been worked out before, and the use of this bar as the final reference standard for length was authorized by act of Congress passed in 1893.

As to one bar being incommensurable with the other, our contemporary is entirely mistaken on that point, because the relation between the bars has been very carefully determined and is officially expressed in figures of only two decimal places. But even supposing the relation could be expressed by a long string of decimals only, as our contemporary no doubt thinks is the case, even then the bars would be incommensurable only in the sense that the circumference of a circle is incommensurable with its diameter. But for most purposes the expression d 3.1416 is considered close enough, and very many engineering and mechanical problems—even where extreme accuracy is aimed at —are worked out sufficiently close by its employment. But if for determining how long a piece of yarn it will take to go around a skein of given diameter, or if for any other purpose one must work much closer than machine constructors usually do, he can take the expression d 3.14159265359. This, it is true, does not give the exact relation, but perhaps it will be close enough. If not, then by reference to certain old mathematical works the decimals can be found carried out to the length of about a yard. Of course it is believed that there is no end to the decimal string, and that one who wishes to find out precisely what the circumference of a given circle is will have to be satisfied with an approximation. Most people do not worry about this, however, so long as the ascertained approximation is sufficient for their purpose. The wagon maker who should worry because he could not figure the precise length of a tire for a given size of wagon wheel would of course be making himself ridiculous, and that is just what our textile contemporary is doing when it worries over the alleged fact that the yard and the meter are incommensurable. The expression for their relative length has been determined by the most refined means known to the science of mensuration, and we can assure our contemparary that in the practise of measuring things, it will never be able to come anywhere near discovering the residual error, if there is one. Our con-

temporary knows a number of useful things relating to "yarns," "skeins," "picks," "hanks," etc. If it is wise it will not meddle with other things so evidently beyond its sphere of cognition; especially not without first making an enquiry or two of those who may be supposed to be informed about them.

Long-Lived Steam Hammer.

The Niles-Bement-Pond Company recently received a repair order for a Bement 2,000-pound steam hammer which was shipped to the Columbus, Chicago & Indiana Central Railroad on March 25, 1868. This indicates a remarkable life for a steam hammer, and it is safe to say that most of them are scrapped long before attaining an age of thirty-seven. It will soon reach the fatal age of forty years.

We have illustrated various devices for filing slots in armatures, and we note that the Chicago Pneumatic Tool Company has made an ingenious application of a sand rammer to this work. The armature is mounted upon centers and the sand rammer is arranged to hold the file in the proper position, while of course it is its special business to impart the required reciprocating motion. The device is said to work well.

New Tools and Machine Shop Appliances.

A COAL-OIL SHOP FORGE.

The illustration shows a coal-oil forge which has been brought out by the Burke Machinery Co., Cleveland, Ohio. The base of the machine is of gray iron and forms a tank for holding the coal oil. This tank is tested to 100 pounds pressure. It holds sufficient oil to run the forge several days. The forge is furnished with an air pump, the handle of which may be seen on the left side of the tank. For ordinary work air is pumped into the tank—on top of the oil—till the gage shows 25 or 30 pounds. At this pressure the forge will run 10 hours on a consumption of about 1½ gallons of oil.

A COAL-OIL SHOP FORGE.

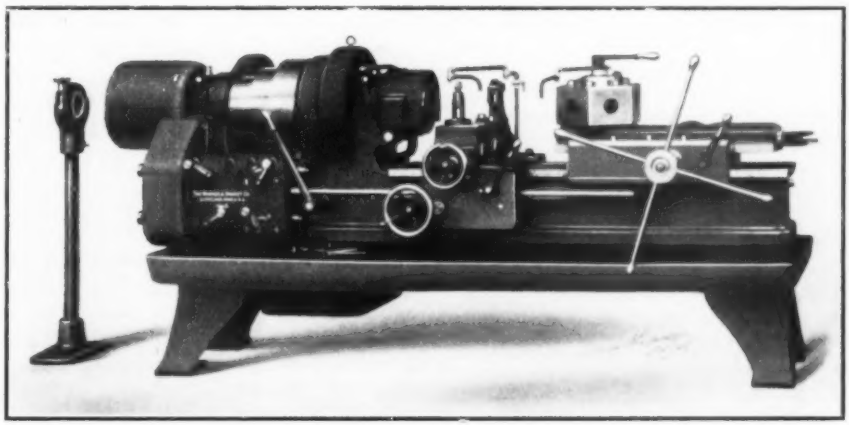
At 75 pounds pressure the forge will melt tool steel, but of course the oil consumption will be greater.

The burner is a standard hydro-carbon coil burner equipped with one needle valve and one regulating valve. It is enclosed in a gray-iron case which retains the heat and prevents the burner from being affected by drafts when the forge is used out of doors. No blower is necessary, the gas combining with the surrounding air makes its own mixture.

The fire-brick dome consists of five pieces—the dome proper, a plug for the hole in the top, a piece to close the back of the dome, an angle plate to close the front, and a small fire-brick table upon which delicate work should be placed while being heated, so that the heat may be better distributed. The hole in the top of the dome is large enough to receive the small gray-iron pot shown at the extreme left. In this pot babbitt metal or lead may be melted. The forge being self-contained, is easily portable.

A TURRET SCREW MACHINE.

The illustration shows a turret screw machine of new design by the Warner & Swasey Company, Cleveland, Ohio, this being one of a complete line of this type. It takes bar stock up to 3⅝ inches in diameter, thru the automatic chuck. The travel of the turret slide is 14 inches. The swing over bed is 20 inches. The head and bed are cast in one piece. The cone has three steps for 4-inch belt, is geared 1.85 to 1 and back-geared 7.44 to 1; the back gear being engaged and disengaged by friction clutches. There are twelve spindle speeds, from 15 to 156 revolutions per minute. The automatic chuck and the power roller feed handle



A TURRET SCREW MACHINE.

bar stock of any shape. The chuck is operated by the long lever in front of the head, working thru a system of compound levers which gives a powerful movement for closing the jaws, and the same lever also engages and disengages the roller feed. The chuck jaws are adjustable for variations from actual size to 1-16 inch smaller. An outer stock support accompanies the machine. The turret saddle is provided with a supplementary taper base, by means of which the center of the tool-holes in the turret can be adjusted to the exact hight of the center of the spindle. Taper gibs, fitted the whole length of the saddle on each side, provide means of adjusting the slide sideways. The turret slide is equipped with geared automatic feed, with four changes in either direction, from 20 to 102 turns per inch. The turret has six tool-holes 2½ inches in diameter and also bolt-holes for attaching tools to the faces. It is so arranged that stock of any diameter, smaller than the tool-holes can pass entirely thru. The index is nearly the full diameter of the turret, and the lock bolt is placed directly under the working tool. An independent adjustable stop is provided for each face. The carriage has geared automatic cross feed, with four changes in either direction, from 61 to 306 per inch; and hand longitudinal feed. A tool post for holding forming and turning tools, and a cutting-off tool holder are provided. The geared feeds insure a positive drive and any one of the changes is instantly available by shifting a lever. The turret and carriage feeds are independent of each other, and both are provided with adjustable automatic trips.

The geared pump delivers a copious flow of oil to the cutting tools for both the turret and carriage, thru two systems of piping. It operates when running in either direction. A double friction countershaft accompanies the machine as regularly furnished, arranged for belt drive. Motor drive can readily be applied. The net weight of the machine is about 6000 lbs.

The Swiss Government, as stated by the *Deutsche Industrie-Zeitung*, has invited most of the European governments to participate in a congress to meet in Berne, May 8, 1905, to consider the protection of workmen. The program of discussion includes a prohibition of the use of white phosphorus in the manufacture of matches and a prohibition, with some qualifications, of the employment of female labor in the industries at night. It is significant to note that the names of the countries included in the invitation, as reported, while embracing almost every other European sovereignty except Turkey, leave out Russia.

The C. W. Hunt Company is sending out to its friends a copy of a metric conversion table which is very conveniently arranged and with a gummed back so that it may be readily pasted in one's memorandum book.

Personal.

William C. Briggs has recently been appointed superintendent of the works of the Samuel L. Moore's Sons Corporation, Elizabeth, N. J.

The business of Julius Jonson, iron founder and contracting engineer, New York city, who has lately retired, will be continued at 79 East 130th street by Herman and Julius Jonson under the firm name of Julius Jonson's Sons.

E. J. O'Hagan, formerly with the Winton Motor Car Company, Cleveland, Ohio, is now superintendent with the Waltham Manufacturing Company, Waltham, Mass., manufacturer of air-cooled gasoline touring cars and runabouts. This company has recently increased its equipment and will shortly ship twenty-five cars per week.

Obituary.

Thomas Hayes, for many years superintendent of the Edge Hill Iron Works, Montgomery County, Pa., died in Philadelphia, February 19, sixty-five years old.

William S. Earl, head of the well-known collar manufacturing firm of Earl & Wilson, Troy, N. Y., who died February 25, eighty-two years old, began his industrial life and worked for many years as a molder in one of the then well-known iron foundries of Troy.

Edward Harvey Middleton died in Philadelphia, February 22, fifty-seven years old. He was a member of a family which has been associated with the iron and steel trade for more than a century. He was owner of the Frankford Machine Company, Philadelphia, until 1901, when he retired in favor of his sons.

S. L. Barriett, of the Barriett Electric Company, Cincinnati, died about the middle of February. He was an inventor of considerable note, particularly in the line of electrical machinery. He organized the Cincinnati Electric Motor Company, the name of which was recently changed to the Barriett Electric Company. The works were equipped with an extensive line of automatic tools and apparatus of his invention.

Norton P. Otis, chairman of the board of directors of the Otis Elevator Company, died at Yonkers, N. Y., February 20, sixty-four years old. Mr. Otis was a son of the inventor of the Otis elevator, and at the age of eighteen he entered his father's establishment, rising thru various positions of responsibility to that which he finally held. Mr. Otis had been mayor of Yonkers, a Member of Assembly, New York, and was ending his term as Member of Congress.

Edward Longstreth, until 1886 one of the owners of the Baldwin Locomotive Works, died in Philadelphia, February 23, sixty-five years old. Mr. Longstreth was a descendant of Bartholomew Longstreth, who came from Longstreth Dale, Yorkshire, England, and he was born on the Longstreth homestead in Bucks county, Pa. He began a five years' apprenticeship at the Baldwin works in 1857 and before four years had e apsed he had become a foreman of one of the shops. He exhibited energy and studiousness and developed great inventive ability. He developed and perfected the gage system which is now the characteristic feature and a most important factor in the success of the Baldwin works. In 1867 he was made general superintendent of the works, and in 1870 he became a partner, retaining entire control of the mechanical and construction department with a force of three thousand men. He was the youngest and one of the most important members of the firm. He retired from business in 1886 with impaired health. His fortune made in the locomotive business had been increased by judicious investments. He had been a vice-president of the Franklin Institute and held official positions in various financial institutions. He was a Quaker, and his funeral was conducted according to the Quaker ritual.

Business Items.

The Nordberg Manufacturing Company, of Milwaukee, Wis., has opened a New York office at 42 Broadway, in charge of F. W. O'Neil, mechanical and mining engineer.

Chas. W. Cross, M. E., E. E., formerly of the Roberts & Abbott Company, consulting engineers, of Cleveland, O., and later electrical engineer for the Eastern Ohio Traction Company, has entered the employ of the Crocker-Wheeler Company, of Ampere, N. J., and is attached to the Cleveland office of the company, at 816 New England Building.

The Northern Engineering Works, Detroit, Mich., have been awarded a contract for the electric traveling cranes required in the new plant of the Detroit Steel Casting Company. There will be one 30-ton, four-motor crane and two 10-ton, three-motor cranes, all 70-foot span. They have also secured contract for one three-motor, 5-ton special electric traveling crane from the Michigan Malleable Iron Company.

Owing to the greatly increased traffic on the interurban railway system of the Los Angeles-Pacific Railroad Company, it has decided to increase the capacity of its central power-house at Vineyard and to install an additional substation in Los Angeles. The new electrical equipment has recently been contracted for with the Crocker-Wheeler Company, thru its Pacific Coast managers, the Abner Doble Company, of San Francisco.

The Northern Electrical Manufacturing Company, Madison, Wis., has found extensive sale for its single-voltage, two-wire, variable-speed motors in all lines of industrial work. The field of the variable-speed motor is primarily the machine shop, as no other line of work calls for so many individual machines. However, Northern variable-speed motors are used in all kinds of industries, for operating pumps, for boiler feed, circulation, etc.; ventilating and blowing fans; elevators, hoists, conveyors, etc. An extensive field for Northern variable-speed motors has been found in the cement industry, where variable-speed drive is especially advantageous.

The Westinghouse Companies have just entered an order for the equipment of a power-house for the electrical operation of gold dredging boats on the Alaskan rivers. The plan is an entirely new one, and involves many interesting features. After consider-

ing various plans, it was decided to install a 400-kilowatt turbo-generator in the power-house, to be driven by a 600 horse-power Westinghouse-Parsons steam turbine. The dredge boats are being built by the Marion Steam Shovel Company, of Marion, Ohio. On these boats will be installed induction motors, aggregating a total of about 500 horse-power, and varying in size from 7½ to 100 horse-power. The power-house will be located at Dawson City, and the dredges will operate on the Yukon River and its tributaries. Lines for transmitting power will be strung from the station to the boats, wherever they may be working.

Six pump manufacturing concerns invited to bid on a job and only two willing to estimate on it—this was the situation that confronted the engineers of the Pneumatic Engineering Company when they undertook to install an air-lift system in the plant of the Scranton Cold Storage & Warehouse Company, Scranton, Pa. The well from which the water was to be pumped is sunk 835 feet from the surface, passing thru coal measures for a distance of almost 450 feet. The fact that coal surrounds the well for such a great distance was an additional obstacle to a successful installation, as it rendered the water poisonous and unfit for use. To overcome the contamination caused by the strata of coal, it was necessary to sink a casing 8 inches in diameter around the outside of the well for a distance of 450 feet, the casing then being filled with a thin cement composed of equal parts of clear Portland and sand. The air-lift pipes were then submerged 500 feet, making a lift to the surface of 190 feet, and from this point pipes were led 104 feet to a tank placed on the roof of the building. The power end of the system consists of one 12x11x16 straight-line Rand compressor, a machine requiring very little attention and taking up a small amount of space. The compressor was started at 75 revolutions per minute, and at a pressure of 105 pounds lifted the water 294 feet at the rate of 8,000 gallons in ninety minutes, or 104,006 gallons every twenty-four hours.

Manufacturers.

J. H. Newbury, Goshen, N. Y., will build an addition to his foundry.

Almy & Thomas, Corning, N. Y., will double the capacity of its cut-glass plant.

The plant of the Bowser Oil Tank Works, at Fort Wayne, Ind., will be enlarged.

Chas. Hanika, Muncie, Ind., will build an architectural iron works there shortly.

The Continental Sugar Company will establish a large refinery at Blissfield, Mich.

The Radium Gas Machine Company, Denver, Colo., is looking for a building site.

The Western Foundry Company, Chicago, Ill., is building an addition to its plant.

Fairbanks & Dorr will increase the capacity of their woolen mill at Guild, N. H.

F. L. Brodt, Muncie, Ind., contractor and tank builder, will locate in Westfield, Ill.

A new ice factory will be constructed at Mokelumne Hill, Cal., for Werle Brothers.

The machine shop of Estes S. Ruggles & Son, Ware, Mass., has been destroyed by fire.

The American Radiator Company, Chicago, Ill., will erect a new building in Omaha, Neb.

The Lenoir Car Company, Lenoir City, Tenn., is doubling the capacity of its plant.

The B. & O. machine shops at Loraine, O., were damaged by fire to an extent of $100,000.

The G. & H. Barnett Company, Philadelphia, Pa., tile manufacturer, will erect a factory.

Armour & Co. will increase their plant at Hazleton, Pa. Two new smoke-houses will be built.

The Adams (Tenn.) Planing Mill Company has been incorporated; J. H. Clunard, president.

The American Flax Fiber Company, San Francisco, will erect a factory in Chehalis, Wash.

The Barney & Smith Car Company, Dayton, O., is contemplating the enlargement of its plant.

The Superior Cement Roofing Company has been organized at Bryan, O., and will erect a factory.

T. J. Galloway will erect a factory in Johnson City, Tenn., for the manufacture of insulator pins.

The Phoenix Silk Manufacturing Company, of Paterson, N. J., will erect a mill in Allentown, Pa.

The Greendale Gas Engine Company has in contemplation the erection of a factory at Greendale, Mass.

It is reported that the Forde Lighting Company, of Garrettsville, O., will establish a plant in Toledo.

The City Council of Lake Charles, La., is considering plans and specifications for a city lighting plant.

The Kinnear Pressed Radiator Company has bought land in West Pittsburg, Pa., and will erect a plant.

The Eastwood Wire & Chemical Manufacturing Company, Belleville, N. J., will build an addition to its plant.

It is said that the Elgin (Ill.) Hydraulic Company is discussing plans for the erection of an electric light plant.

The O. S. Kelly Western Manufacturing Company, Iowa City, Ia., is planning the erection of a new foundry.

The Enterprise Foundry Company, Auburn, N. Y., will install a brass plant in connection with its gray-iron foundry.

The Echo Manufacturing Company, Tonawanda, N. Y., will erect a new factory for the building of gasoline boats.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Wire and sheet metal working machinery and tools. Emmons Collins, Chicago.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Any manufacturer desiring to build gas engines address Box 324, AMER. MACHINIST.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Special machinery to order. Geo. M. Mayer, M. E., 1131 Monadnock, Chicago, Ill.

Designs and shop drawings properly executed by Geo. Schwarz & Co., Room 604, 150 Nassau st., New York.

Salesman of machinery supplies to handle "Lang's T-bolt heads" on commission. G. R. Lang Co., Cincinnati, O.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—One No. 19 Bliss press, in good condition, or machine of similar dimensions. Briscoe Mfg. Co., Newark, N. J.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

A firm of practical, commercial engineers desires to represent manufacturers of power plant equipment in N. E. territory. Address Johnson & Blanding, 49 Westminster st., Providence, R. I.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, gray, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

Wanted—To furnish competent men for positions as managers and heads of departments in the metal-working or machine business and the past experience of each, for which there is no charge; also want competent men to register for such positions. Address James Brady, 168 Lefferts Place, Brooklyn, N. Y.

Old-established London firm, with large connection, premises and staff (showing at The Naval Exhibition, Earls Court), are open to undertake sole London agency for high-class specialties used by all steam users and engineers. Address full particulars, Box 24915, C. A. G. Browne's Advertising Agency, 53 Wych st., Strand, London, W. C., England.

Mechanical engineer, with established suite of offices, centrally located, Chicago, desires to establish Western branch, with Chicago headquarters, for Eastern house with established reputation in machinery, tools transmission, or specialty of approved merits, requiring high-grade, successful pusher; 20 years' experience in mechanical line. Address Will Doit, 221 Belle Plaine, Chicago.

Machine Shop and Foundry.—We offer a complete machine shop and foundry, fully equipped with modern machinery; has five lathes, four planers, including 48 in. x 48 in. x 10 ft. Pond, three drills, shaper, milling machine, gear cutter, keyseater, 30 H.-P. gas engine, lighting dynamo and many other machines. Patterns for a complete and profitable line of standard machines. Plenty of jobbing work. The foundry has complete equipment. Located in a good Ohio city. Price less than one-half original cost, and will be sold on easy terms. Business is improving rapidly. By spring all the shops will be full of work. Now is the time to start in business. Wm. A. Reade & Co., 402 Chamber of Commerce Bldg., Cleveland, Ohio.

For Sale.

For Sale—Long-established machine shop in this thriving city; cause of sale, death in firm. W. D. Judson, New Haven, Conn.

For Sale—Good will, patents and patterns for shaper business; 1,800 made and sold; patterns for three different styles, eleven sizes. Address Box 345, AMER. MACHINIST.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

For Sale—A very desirable machine and repair shop, residence, location and business; manufacture wood-sawing machinery, which is in great demand; more business than can attend to; want to retire; a bargain. Irving Fox, Rochester, Minn.

For Sale or Rent—A fully equipped machine shop for general work, employing about 20 men, in a city of 35,000 population in central Illinois; the opportunity of a lifetime for a hustling, practical mechanic. Address Box 342, AMERICAN MACHINIST.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Superintendent or foreman, drop forge shop; experience both die-sinking and forging departments, also experience handling help. Address Box 337, AMER. MACHINIST.

Successful gas engine and automobile designer, aged 30, desires change; drawing room, manufacturing, testing and driving experience; practical and well informed. Box 335, AMERICAN MACHINIST.

ILLINOIS.

Foreman of wood and metal pattern shop desires position where he can utilize his ability to better advantage. Box 338, AM. M.

Broadly qualified machine works general superintendent, desiring new location, invites confidential inquiries; state particulars. "Conservant," care AMERICAN MACHINIST.

Permanent position, by quick estimator and competent designer of inventive and executive ability; traveling cranes, elevators and general hoisting machinery; qualified to start concern in these branches; references; location immaterial; technical education. Box 273, AMERICAN MACHINIST.

Situation wanted with a new concern about to begin manufacturing some specialty or small, complicated machine; applicant is a machinist and toolmaker, capable of receiving the highest rate of wages at the bench, and is familiar with tools and methods for producing high-grade, interchangeable work, such as optical, typewriter, stamps, electrical supplies, etc.; competent to design tools and make drawings; 2 years as foreman of toolroom employing 40 toolmakers; some experience in manufacturing; reference. Address Box 336, AMERICAN MACHINIST.

MASSACHUSETTS.

Tool grinder, first class, all round, wants position. Box 350, AMERICAN MACHINIST.

Cost and estimate clerk; 12 years' experience; excellent system at hand, easily applied; correspondence solicited. Box 346, AMERICAN MACHINIST.

NEW JERSEY.

Toolroom foreman, thorough mechanic, desires change; A1 references. Box 353 A. M.

Mechanical and electrical engineer wants position; 8 years' experience, shop and drafting room. Box 347, AMERICAN MACHINIST.

Position as superintendent or general foreman, by an up-to-date American; 15 years' practical experience on steam and gas engines, pumps, air compressors, hoisting machinery, etc.; understands cost-reducing and cost keeping systems; married; age 36; best references. Box 355, AMERICAN MACHINIST.

NEW YORK.

Expert designer on gasoline engines wants responsible position; age 32 and married. Box 351, AMERICAN MACHINIST.

A1 designer-draftsman of gasoline engines and automobiles free for engagement; college graduate; 30 years old. Box 352, AM. MACH.

Mechanical superintendent open for position; first class in every particular; well acquainted with explosive engines. Box 354, AMERICAN MACHINIST.

Traveling salesman wishes to represent manufacturer of machinery or appliances, where shop experience and technical knowledge are necessary. Box 329, AMER. MACH.

Wanted—Situation at experimenting, or develop small machinery similar to adding machine, typewriters, etc.; 18 years' experience; best of references. Box 341, AMER. MACH.

Wanted—Position, by brass foundry foreman; 10 years' experience as foundry foreman; good, all-around mechanic on green or dry sand work. Box 331, AMER. MACHINIST.

American, English and German experience; expert on interchangeable manufacture, gauges, jigs, fixtures; systematizer, designer and draftsman; superintendent or other position. Box 321, AMERICAN MACHINIST.

Structural mill engineer seeks responsible position; specialist steel frame buildings, power plants; guarantees 10 per cent. saving and increased efficiency; salary $175; 7 years present position. Box 330, AM. M.

By an up-to-date mechanic, position as a master mechanic, general foreman or improver; using high-speed steel in all its branches; good handler of men; good designer of labor saving tools; moderate salary; best of references. Box 356, AMERICAN MACHINIST.

Position wanted by first-class machinery salesman, graduate of European college; has been engaged the past 10 years selling to the trade and consumers, machinery, tools and supplies in Europe; would prefer to represent an American house in Germany, Russia or any part of Europe; conversant with English, German, Russian and French languages; good correspondent and thorough expert in his line. Address Box 340, AMER. MACH.

OHIO.

Experienced iron foundry foreman, engine and machine work, best references, wishes position. Box 332, AMERICAN MACHINIST.

Machine tool designer, expert, fully competent in jigs and fixtures, broadly qualified, hustler and accurate worker, wants engagement with first-class concern. Address Box 348, AMERICAN MACHINIST.

PENNSYLVANIA.

Mechanical engineer and designer wants position with manufacturers building general machinery. Box 314, AMER. MACHINIST.

A1 mechanical draftsman, Swedish graduate, 6½ years' experience in Sweden, 15 months in America, wishes a change; refrigerating and Corliss. Box 334, AM. M.

Permanent position is wanted as designer and draftsman, by man of proven ability; Corliss or automatic engine work preferred; am capable of taking entire charge. Box 333, AMERICAN MACHINIST.

WISCONSIN.

Mechanical engineer, technical graduate, age 36, 8 years' experience machine shop, drafting room, erection and operation of power plants, construction of steel buildings and concrete foundations, is open for engagement. Box 339, AMERICAN MACHINIST.

Wanted—By a superintendent desiring a change; 38 years; wide experience; special machinery, tool building, designing, gas, gasoline engines; a hustler, with a forte for putting old and new plants in shape to produce a maximum of high-grade work at a minimum cost; based on the simplest and most practical of modern ideas; A1 references. Box 349, AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Foreman for Canadian machine shop turning out duplicate work; applicants must be first-class mechanics, well up in modern shop practice and know how to handle men to advantage; wages $5 per day; yearly contract to right man, with a chance to improve his position. Box 323, AMER. MACH.

MASSACHUSETTS.

Wanted—Good vise and floor hands; those familiar with printing press work preferred. Campbell P. P. & Mfg. Co., Taunton, Mass.

Wanted—One Gleason bevel gear planer man, one all-round toolmaker, also a man experienced on flat turret work, also one man experienced on spiral gear cutting, also one young man in office with experience on gear work. Address Boston Gear Works, Boston, Mass.

MICHIGAN.

Wanted—A wide-awake young man of clean character and habits, who has learned his trade in a first-class shop and is accustomed to accurate vise work; good opportunity for advancement with growth of business. Address, giving experience and references, "Tools," care AMERICAN MACHINIST.

NEW YORK.

Gear Men.—One foreman and three workmen in our gear-cutting department; must have had practical experience. P. D. Co., care AMERICAN MACHINIST.

Wanted—First-class general superintendent for manufacturing business on iron goods with foundry and machine shop. Box 343, AMERICAN MACHINIST.

A first-class designer of wood-working machinery, with knowledge of power transmission machinery; state experience, where formerly employed, age and salary expected. Answer P. A., care AMERICAN MACHINIST.

Wanted—A first-class machinery salesman to handle a high-grade machine tool as a side line, or in conjunctoin with one or two other good things. Apply at once, giving references and experience, Rochester Die Shaper Co., Rochester, N. Y.

An Immediate Position.—Auditor and executive manager, $5,000; secretary, $1,000; clerk, $1,000; correspondent, $2,000; salesman, $1,800; must be filled immediately; write for plan. Business Opportunity Co., No. 1 Union Square, New York.

Machinist wanted with a thorough knowledge of machines for extracting fiber from banana leaves and stalk, for the purpose of designing, building and operating a machine of this kind. Address "Machinist and Draftsman," care AMERICAN MACHINIST.

OHIO.

Mechanical draftsman, with experience in artificial or producer gas plants. The Gas Machinery Company, Cleveland, O.

Wanted—Experienced young foreman in Cincinnati for bench work on engines. Address "Bench Shop Foreman," care Cincinnati Metal Trades, Cincinnati, O.

Wanted—Young erecting shop foreman in Cincinnati, experienced in engine work. Address "Erecting Shop Foreman," care Cincinnati Metal Trades, Cincinnati, O.

Wanted—Young foreman for lathe shop in Cincinnati; must be experienced in both light and heavy work. Address "Lathe Shop Foreman," care Cincinnati Metal Trades, Cin., O.

Superintendent for manufacturing machine shop, employing 225 men; must be thoroughly competent and up to date; state experience, age and salary expected. Box 344, AMERICAN MACHINIST

PENNSYLVANIA.

Machine and floor hands familiar with machine tool work. Standard Engineering Works, Ellwood City, Pa.

TENNESSEE.

Wanted—Factory superintendent; an experienced man for large plant, manufacturing coal mine machinery, contractors' cars, standard steel car repair department, locomotive repair department and doing a general machine business, structural iron work, etc.; applicant must be well up on cost reducing; state salary expected, age, past experience and references. Address Wm. J. Oliver Mfg. Co., Knoxville, Tenn.

WISCONSIN.

Wanted—Toolmaker foreman; a man for tool department of well-established electrical manufacturing company; one who thoroughly understands the work and who has had previous experience as foreman; state age, experience, references and salary wanted, also if married or single. Box 511, AM. MACH.

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Rogers & Hubbard Co., Middletown, Conn.

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Zeller, Geo. A., St. Louis, Mo.

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Hoggson & Pettis Mfg. Co., New Haven, Conn.
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Whiton Mach. Co., D. E., New London, Conn.

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$1\frac{1}{2}$ in.	$\frac{7}{8}$ in.
$1\frac{3}{4}$ in.	1 in.
2 in.	$1\frac{1}{8}$ in.

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PITCH	DIAMETER OF ROLL
1 in.	$\frac{9}{16}$ in.
$1\frac{1}{4}$ in.	$\frac{5}{8}$ in.
$1\frac{1}{2}$ in.	$\frac{3}{4}$ in.
$1\frac{3}{4}$ in.	1 in.
2 in.	$1\frac{1}{8}$ in.

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The PITCH SIZES advance uniformly, but the DIAMETERS are irregular and not in perfect proportion.

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Niles-Bement-Pond Co., New York.

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Barnes Co., W. F. & John, Rockford, Ill.
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Garvin Mach. Co., New York.
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McCabe, J. J., New York.
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Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Norton & Jones Mach. Tool Wks., Plainville, Conn.
Prentiss Tool & Supply Co., New York.

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Hisey-Wolf Mch. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

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Dreses Mach. Tool Co., Cincin., O.
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Fosdick Mach. Tool Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.

Drilling Machines, Radial *Continued*
Mueller Mach. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Smith Co., Chas. G., Pittsburg, Pa.
Vandyck Churchill Co., New York.

Drilling Machines, Turret
Niles-Bement-Pond Co., New York.
Quint, A. D., Hartford, Conn.

Drilling Machines, Upright
American Tool Wks. Co., Cin., O.
Aurora Tool Wks., Aurora, Ind.
Baker Bros., Toledo, O.
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Barnes Co., W. F. & John, Rockford, Ill.
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Blaisdell & Co., P., Worcester, Mass.
Boynton & Plummer, Worcester, Mass.
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Cincinnati Mach. Tool Co., Cincinnati, O.
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Davis Mach. Co., W. P., Rochester, N. Y.
Dwight Slate Mach. Co., Hartford, Conn.
Fairbanks Co., New York.
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Drills, Center
Pratt & Whitney Co., Hartford, Conn.
Slocomb Co., J. T., Providence, R. I.
Standard Tool Co., Cleveland, O.

Drills, Hand
Dallett Co., Thos. H., Phila., Pa.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.

Drills, Pneumatic
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Cleveland Pneu. Tool Co., Cleveland, O.
General Pneu. Tool Co., Montour Falls, N. Y.
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Niles-Bement-Pond Co., New York.
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Rand Drill Co., New York.

Drills, Rail
Niles-Bement-Pond Co., New York.

Drills, Ratchet
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Parker Co., Chas., Meriden, Conn.
Pratt & Whitney Co., Hartford, Conn.
Standard Tool Co., Cleveland, O.

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Robbins & Myers Co., Springfield, Ohio.
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Sprague Elec. Co., New York.
Stanley Elec. Mfg. Co., Pittsfeld, Mass.
Sturtevant Co., B. F., Hyde Park, Mass.
Triumph Elec. Co., Cincin., O.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Electrical Supplies
American Elec. & Controller Co., New York.
Clark, Jr., & Co., Jas., Louisville, Ky.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Supply Co., Cleveland, O.
General Elec. Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Roth Bros. & Co., Chicago, Ill.
Stanley Elec. Mfg. Co. Pittsfield, Mass.
Triumph Elec. Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Electrically Driven Tools and Machinery
American Tool Wks. Co., Cin., O.
Clark, Jr., & Co., Jas., Louisville, Ky.
Electric Controller & Supply Co., Cleveland, O.
Hisey-Wolf Mach. Co., Cincin., O.

Elevators
Albro-Clem Elevator Co., Philadelphia, Pa.
Curtis & Co. Mfg. Co., St. Louis, Mo.
Morse, Williams & Co., Phila., Pa.

Emery Wheel Dressers
Desmond-Stephan Mfg. Co., Urbana, O.
Dickinson, Thos. L., New York.
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Heald Machine Co., Worcester, Mass.
Standard Tool Co., Cleveland, O.

Emery Wheels
See Grinding Wheels.

Enclosures, Tool-room
Merritt & Co., Philadelphia, Pa.

Engineers, Electrical
Crocker-Wheeler Co., Ampere, N. J.

Engines, Automobile
Franklin Mfg. Co., Syracuse, N. Y.
Olds Gasoline Engine Works, Lansing, Mich.

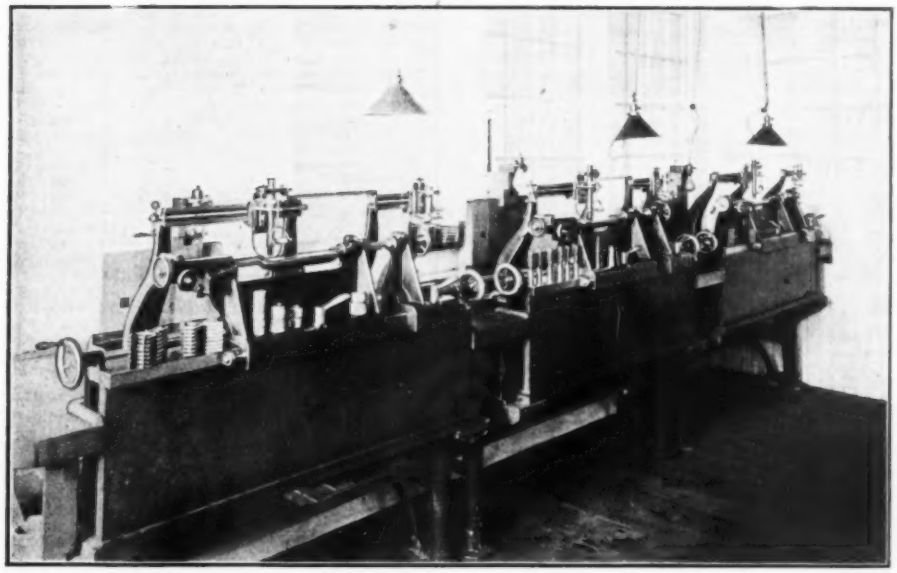
Engines, Gas and Gasoline
Columbus Mach. Co., Columbus, O.
Foos Gas Eng. Co., Springfield, O.
Jacobson Mach. & Mfg. Co., Warren, Pa.
Mathews, Hugh, Kansas City, Mo.
Mietz, August, New York.
New Era Gas Engine Co., Dayton, Ohio.
Olds Gasoline Engine Wks., Lansing, Mich.
Pierce-Crouch Engine Co., New Brighton, Pa.
Struthers-Wells Co., Warren, Pa.
Woolley Fdry. & Mach. Co., Anderson, Ind.

Engines, Oil
International Power Vehicle Co., Stamford, Conn.
Mietz, August, New York.

Engines, Steam
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Frick Co., Waynesboro, Pa.

BROWN & SHARPE MFG. COMPANY,

PROVIDENCE, R. I., U. S. A.



Group of Measuring Machines in Gauge Department.

ACCURATE STANDARD GAUGES.

The advantages we have, due to our long experience, the extensive and well equipped gauge department directly in charge of mechanics who have become specialists in this line, enable us to furnish accurately finished gauges.

We can produce more economically and, as a rule, can afford to undersell you even to yourself, aside from relieving you of the annoyance and details of manufacturing.

Prices are Moderate Compared With The QUALITY.

Our experience in the use of gauges is at your service.

The Gauge System being in almost universal use throughout our works, we frequently can be of service in advising as to the style of gauges required for any definite purpose.

COMPLETE GAUGE LIST MAILED TO ANY ADDRESS.

Engines, Steam—*Continued*
Garden City Fan Co., Chicago, Ill.
Rand Drill Co., New York.
Ridgway Dynamo & Engine Co., Ridgway, Pa.
Struthers-Wells Co., Warren, Pa.
Sturtevant Co., B. F., Hyde Park, Mass.

Engraving Machinery
Gorton Mach. Co., Geo., Racine, Wis.

Exhaust Heads
Burt Mfg. Co., Akron, O.
Sturtevant Co., B. F., Hyde Park, Mass.

Exhibition, Machinery
Philadelphia Bourse, Phila., Pa.

Fans, Electric
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sprague Elec. Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Fans, Exhaust
American Blower Co., Detroit, Mich.
Garden City Fan Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

Files and Rasps
Barnett Co., G. & H., Phila., Pa.
Hammacher, Schlemmer & Co., New York.
Montgomery & Co., New York.
Nicholson File Co., Provi., R. I.
Reichheim & Co., E. P., New York.

File and Tool Holders
Bowers Mfg. Co., Geo. W., Boston, Mass.

Filing Machines
Cochrane-Bly Mach. Wks., Rochester, N. Y.

Filters, Oil
Burt Mfg. Co., Akron, O.
Houghton & Co., E. F., Philadelphia, Pa.

Fire Extinguishers
Badger & Sons Co., E. B., Boston, Mass.

Flexible Shafts
Chicago Flexible Shaft Co., Chicago, Ill.
Coates Clipper Mfg. Co., Worcester, Mass.
Gem Mfg. Co., Pittsburg, Pa.
Stow Mfg. Co., Binghamton, N. Y.

Forges
Boynton & Plummer, Worcester, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Burke Machine Co., Cleveland, O.
Ingersoll-Sergeant Drill Co., New York.
Miner & Peck Mfg. Co., New Haven, Conn.
Sturtevant Co., B. F., Hyde Park, Mass.

Forgings, Drop
Billings & Spencer Co., Hartford, Conn.
Clapp Mfg. Co., E. D., Auburn, N. Y.
Page-Storms Drop Forge Co., Springfield, Mass.
Solid Steel Tool & Forge Co., Pittsburg, Pa.
Williams & Co., J. H., Brooklyn, N. Y.
Wyman & Gordon, Worcester, Mass.

Forgings, Hydraulic
Wyman & Gordon, Worcester, Mass.

Forgings, Steel
Heppenstall Forge & Knife Co., Pittsburg, Pa.
Page-Storms Drop Forge Co., Springfield, Mass.
Solid Steel Tool & Forge Co., Pittsburg, Pa.
Wyman & Gordon, Worcester, Mass.

Foundry Furnishings
Byram & Co., Inc., Detroit, Mich.
Gem Mfg. Co., Pittsburg, Pa.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.
Stevens, F. B., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Mass.

Forming Machines
Hartford Mch. Screw Co., Hartford, Conn.

Furnaces, Gas
Am. Gas Furnace Co., N. Y. City.
Chicago Flexible Shaft Co., Chicago, Ill.
Westmacott Co., J. M., Providence, R. I.

Furniture, Machine Shop
New Britain Mach. Co., New Britain, Conn.

Gauges, Recording
Bristol Co., Waterbury, Conn.

Gauges, Standard
Brown & Sharpe Mfg. Co., Providence, R. I.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gauges, Steam
American Steam Gauge & Valve Mfg. Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Gear Cutting Machinery
Adams Co., Dubuque, Iowa.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cin., O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Clough, R. M., Tolland, Conn.
Dwight Slate Mch. Co., Hartford, Conn.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago, Ill.
Ganschow, Wm., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Newton Mach. Tool Wks., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machinery
Gisholt Mach. Co., Madison, Wis.

Gears, Cut
Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila. Pa.
Davis, Rodney, Philadelphia, Pa.
Earle Gear & Mach. Co., Philadelphia, Pa.
Eberhardt Bros. Mach. Co., Newark, N. J.
Fawcus Mch. Co., Pittsburg, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Foote Bros. Gear & Mach. Co., Chicago, Ill.
Ganschow, Wm., Chicago, Ill.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hardinge Bros., Chicago, Ill.
Horsburgh & Scott Co., The, Cleveland, O.
Messmer Mfg. Co., Ferd., St. Louis, Mo.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Wks., Philadelphia, Pa.
Sawyer Gear Wks., Cleveland, O.
Simonds Mfg. Co., Pittsburg, Pa.
Taylor, Wilson & Co., Allegheny, Pa.

Gears, Molded
Caldwell & Son Co., H. W., Chicago, Ill.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Franklin Mfg. Co., Syracuse, N. Y.
Greenwald Co., I. & E., Cincin., O.
Taylor, Wilson & Co., Allegheny, Pa.

Gears, Rawhide
Boston Gear Wks., Boston, Mass.
Chicago Raw Hide Mfg. Co., Chicago, Ill.
Earle Gear & Mach. Co., Philadelphia, Pa.
Fawcus Mch. Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Horsburgh & Scott Co., Cleveland, Ohio.
New Process Raw Hide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.

Gears, Worm
Albro-Clem Elevator Co., Philadelphia, Pa.
Boston Gear Wks., Boston, Mass.
Fawcus Mch. Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Morse, Williams & Co., Phila., Pa.
Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Simonds Mfg. Co., Pittsburg, Pa.
Taylor, Wilson & Co., Allegheny, Pa.

Graphite
Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center
Coates Clipper Mfg. Co., Worcester, Mass.
Heald Mch. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Mueller Mch. Tool Co., Cin., O.
Niles-Bement-Pond Co., New York.

Grinders, Cock
Windsor Mach. Co., Windsor, Vt.

Grinders, Cutter
Automatic Mach. Co., Greenfield, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Greenfield Mach. Co., Greenfield, Mass.
Heald Mach. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rivett-Dock Co., Boston, Mass.
Smith Co., Chas. G., Pittsburg, Pa.

Grinders, Disk
Besly & Co., Chas. H., Chicago, Ill.
Diamond Mach. Co., Provi., R. I.
Heald Machine Co., Worcester, Mass.
Iroquois Mach. Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.

Grinders, Drill
Heald Mch. Co., Worcester, Mass.
Niles-Bement-Pond Co., New York.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinders, Portable
Heald Machine Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.

Grinders, Tool
Armstrong Bros. Tool Co., Chicago, Ill.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Diamond Mach. Co., Prov., R. I.
Gisholt Mach. Co., Madison, Wis.
Gould & Eberhardt, Newark, N. J.
Hisey-Wolf Mach. Co., Cincin., O.
Landis Tool Co., Waynesboro, Pa.
Lutter & Gies, Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, O.
Vandyck Churchill Co., New York.
Walker & Co., O. S., Worcester, Mass.
Whitney Mfg. Co., Hartford, Ct.

Grinding and Polishing Machines
Besly & Co., Chas. H., Chicago, Ill.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.

Grinding and Polishing Machines—*Continued*
Builders' Iron Foundry, Providence, R. I.
Burke Mach. Co., Cleveland, O.
Coates Clipper Mfg. Co., Worcester, Mass.
Diamond Mach. Co., Prov., R. I.
Fairbanks Co., New York.
Goodell-Pratt Co., Greenfield, Mass.
Greenfield Mach. Co., Greenfield, Mass.
Hill, Clarke & Co., Boston, Mass.
Iroquois Mach. Co., New York.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Montgomery & Co., New York.
Niles-Bement-Pond Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Norton Emery Wheel Co., Worcester, Mass.
Norton Grinding Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Rivett-Dock Co., Boston, Mass.
Safety Emery Wheel Co., Springfield, O.
Smith Co., Chas. G., Pittsburg, Pa.
Standard Tool Co., Cleveland, O.
Vandyck Churchill Co., New York.
Vitrified Wheel Co., Westfield, Mass.
Walker & Co., O. S., Worcester, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding Wheels
Adams Co., Dubuque, Iowa.
Builders' Iron Foundry, Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Diamond Mach. Co., Prov., R. I.
Hampden Cor. Wheel Co., Brightwood, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
National Corundum Wheel Co., Buffalo, N. Y.
Niles-Bement-Pond Co., New York.
Norton Emery Wheel Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Scranton Whetstone & Abrasive Wheel Co., Scranton, Pa.
Vitrified Wheel Co., Westfield, Mass.
Whitney Mfg. Co., Hartford, Ct.

Grindstones and Frames
Athol Mach. Co., Athol, Mass.
Cleveland Stone Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

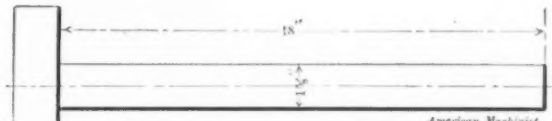
Gun Barrel Machinery
Diamond Mach. Co., Prov., R. I.
Pratt & Whitney Co., Hartford, Conn.

Hack Saw Blades and Frames
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Goodell-Pratt Co., Greenfield, Mass.
Hammacher, Schlemmer & Co., New York.
Millers Falls Co., New York.
Montgomery & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Starrett Co., L. S., Athol, Mass.
West Haven Mfg. Co., New Haven, Conn.

Hack Saws, Power
Diamond Saw & Stamping Wks., Buffalo, N. Y.
Fairbanks Co., New York.
Hoefer Mfg. Co., Freeport, Ill.
Millers Falls Co., New York.
Montgomery & Co., New York.
Niles-Bement-Pond Co., New York.
West Haven Mfg. Co., New Haven, Conn.

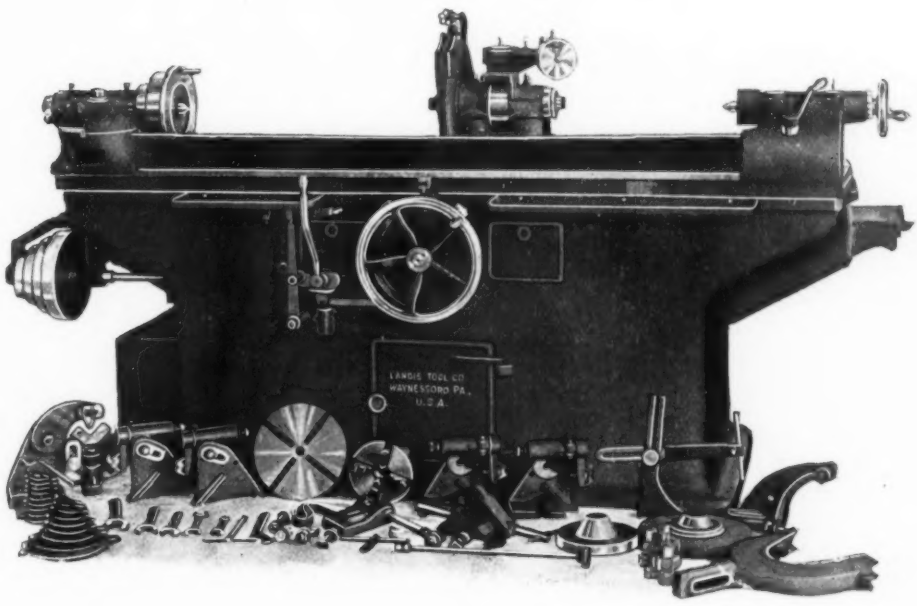
Hammers, Drop
Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Gould & Eberhardt, Newark, N. J.
Miner & Peck Mfg. Co., New Haven, Conn.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Niles-Bement-Pond Co., New York.
Perkins Mach. Co., Warren, Mass.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

It took just 15 minutes for the No. 4 Landis Grinder to remove .012" from the dimensioned surface of the piece of work shown below, and the accuracy limit was .001."



Machinery Steel. .012" Removed from Dimensioned Surface and Finished in 15 Minutes. Accuracy Limit, .001"

The reason why the Landis Grinder can turn out work so fast without in any way sacrificing accuracy, is because every part has been experimented upon, tested under working conditions, altered and redesigned until it was of the right shape and form to give the maximum results. Ask for the Special Circular.



Landis Tool Company, Waynesboro, Pa., U.S.A.

AGENTS—Walter H. Foster Co., 513 Williamson Building, Cleveland, Ohio. Walter H. Foster Co., 114 Liberty Steet, New York. C. W. Burton, Griffiths & Co., London. Schuchardt & Schutte, Berlin, Vienna, Stockholm, St. Petersburg. Alfred H. Schutte, Cologne, Brussels, Liege, Milan, Paris and Bilbao. A. R. Williams Machinery Co., Toronto. Williams & Wilson, Montreal, Canada.

THE LANDIS HIGH DUTY BOLT CUTTER

is an entirely new idea, instead of the usual dies it has a set of chasers which are rigidly held by special jaws. As soon as the dies get dull, it is only necessary to grind the ends—this only takes a few minutes—and place in the jaws, moving them forward enough to compensate for what was ground off. They can be used up to the last inch, and will cut 20 times more work and have 20 times longer life than the hobbed die. May we send you the full particulars?

LANDIS MACHINE COMPANY, - Waynesboro, Pa., U.S.A.

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Northern Elec. Mfg. Co., Madison, Wis.

Hammers, Pneumatic
Chicago Pneu. Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., Cleveland, O.
Dallett Co., Thos. H., Phila., Pa.
Ingersoll-Sergeant Drill Co., New York.
International Steam Pump Co., New York.
Niles-Bement-Pond Co., New York.
Phila. Pneu. Tool Co., Philadelphia, Pa.
Rand Drill Co., New York.

Hammers, Power
Niles-Bement-Pond Co., New York.
Scranton & Co., The, New Haven, Conn.
Sutton Co., C. E., Toledo, O.

Hammers, Steam
Bethlehem Fdry. & Mach. Co., So. Bethlehem, Pa.
Chambersburg Engineering Co., Chambersburg Pa.
Erie Foundry Co., Erie, Pa.
Vandyck Churchill Co., New York.

Handles, Screw Plate
Standard Welding Co., Cleve., O.

Hangers, Shafting
Cresson Co., Geo. V., Phila., Pa.
Hyatt Roller Bearing Co., Harrison, N. J.
Pryibil, P., New York.
Standard Pressed Steel Co., Philadelphia, Pa.

Heaters, Feed Water
Sturtevant Co., B. F., Hyde Park, Mass.

Heating and Ventilating Apparatus
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Garden City Fan Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

Heating Machines
Am. Gas Furnace Co., New York.

Hoisting and Conveying Machinery
Brown Hoisting Mchry. Co., New York.
Caldwell & Son Co., H. W., Chicago, Ill.
Cresson Co., Geo. V., Phila., Pa.
Link Belt Engineering Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Hoists, Electric
C & C Electric Co., New York.
Cleveland Crane & Car Co., Wickliffe, Ohio.
Curtis & Co. Mfg. Co., St. Louis, Mo.
General Pneu. Tool Co., Montour Falls, N. Y.
Maris Bros., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Sprague Electric Co., New York.
Sturtevant Co., B. F., Boston, Mass.
Yale & Towne Mfg. Co., New York.

Hoists, Hand
Harrington, Son & Co., Edwin, Philadelphia, Pa.
International Steam Pump Co., New York.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic
Chicago Pneu. Tool Co., Chicago, Ill.
Curtis & Co. Mfg. Co., St. Louis, Md.
General Pneumatic Tool Co., Montour Falls, N. Y.
International Steam Pump Co., New York.
Phila. Pneumatic Tool Co., Philadelphia, Pa.
Rand Drill Co., New York.

Igniters, Gas Engine
Franklin Mfg. Co., Syracuse, N. Y.
Remy Elec. Co., Anderson, Ind.

Indicators, Speed
Norton Emery Wheel Co., Worcester, Mass.
Starrett Co., L. S., Athol, Mass.

Indicators, Speed, Peripheral
Warner Instrument Co., Beloit, Wis.

Indicators, Steam
American Steam Gauge & Valve Mfg. Co., Boston, Mass.

Industrial Railways
Hunt Co., C. W., West New Brighton, N. Y.
Sturtevant Co., B. F., Hyde Park, Mass.

Injectors
Desmond-Stephan Mfg. Co., Urbana, O.
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Wm., Phila., Pa.

Inspection and Tests
Hunt Co., Robt. W., Chicago, Ill.

Instruction Schools
See Schools, Correspondence.

Insurance, Boiler
Hartford Steam Boiler Insp. & Ins. Co., Hartford, Conn.

Iron Filler
Felton, Sibley & Co., Phila., Pa.

Jacks, Hydraulic
Bethlehem Fdry & Mach. Co., So. Bethlehem, Pa.
Watson-Stillman Co., New York.

Jacks, Planer
Armstrong Bros. Tool Co., Chicago, Ill.

Key Seaters
Baker Bros., Toledo, O.
Burr & Sons, John T., Brooklyn, N. Y.
Chattanooga Mchry. Co., Chattanooga, Tenn.
Davis Mach. Co., W. P., Rochester, N. Y.
Niles-Bement-Pond Co., New York.
Whitney Mfg. Co., Hartford, Ct.

Keys, Machine
Standard Gauge Steel Co., Beaver Falls, Pa.
Whitney Mfg. Co., Hartford, Ct.

Lamps, Arc
General Electric Co., N. Y. City.
Stanley Elec. Mfg. Co., Pittsfield, Mass.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Lamps, Incandescent
General Electric Co., New York.
Stanley Elec. Mfg. Co., Pittsfield, Mass.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Lathe Attachments
American Tool Wks. Co., Cin., O.
Bradford Machine Tool Co., Cincinnati, O.
Niles-Bement-Pond Co., New York.
Osgood, J. L., Buffalo, N. Y.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.

Lathe Dogs
Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Besly & Co., Chas. H., Chicago, Ill.
Le Count, Wm. G., So. Norwalk, Conn.
Pratt & Whitney Co., Hartford, Conn.
Tindel-Morris Co., Eddystone, Pa.

Lathes
American Tool & Mach. Co., Boston, Mass.
American Tool Wks. Co., Cin., O.
Automatic Mach. Co., Greenfield, Mass.
Barnes Co., B. F., Rockford, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bertram & Sons Co., Ltd., John, Dundas, Ont., Canada.
Blaisdell & Co., P., Worcester, Mass.
Blount Co., J. G., Everett, Mass.
Bradford Mach. Tool Co., Cin., O.
Bridgeford Machine Tool Works, Rochester, N. Y.
Bullard Mach. Tool Co., Bridgeport, Conn.
Davis Mach. Co., W. P., Rochester, N. Y.

Lathes —*Continued*
Diamond Machine Co., Prov., R. I.
Draper Mach. Tool Co., Worcester, Mass.
Dreses Mach. Tool Co., Cincin., O.
Fairbanks Co., New York.
Fay & Scott, Dexter, Me.
Flather & Co., Nashua, N. H.
Garvin Mach. Co., New York.
Gisholt Machine Co., Madison, Wis.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Ct.
Hill, Clarke & Co., Boston, Mass.
Le Blond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
McCabe, J. J., New York.
Marshall & Huschart Mchry. Co., Chicago, Ill.
Mergenthaler Co., Ott., Baltimore, Md.
Motch & Merryweather Co., Cleveland, O.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Osgood, J. L., Buffalo, N. Y.
Prentiss Tool & Supply Co., New York.
Robbins, L., Worcester, Mass.
Schumacher & Boye, Cincinnati, Ohio.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Shepard Lathe Co., Cincinnati, O.
Smith Co., Chas. G., Pittsburg, Pa.
Springfield Mch. Tool Co., Springfield, O.
Sutton Co., C. E., Toledo, O.
Vandyck Churchill Co., New York.
Von Wyck Mach. Tool Co., Cincinnati, O.

Lathes, Automatic Screw-Threading
Automatic Machine Co., Bridgeport, Conn.
Pratt & Whitney Co., Hartford, Conn.

Lathes, Bench
American Watch Tool Co., Waltham, Mass.
Blount Co., J. G., Everett, Mass.
Faneuil Watch Tool Co., Boston, Mass.
Fenn-Sadler Mach. Co., Hartford, Conn.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Stark Tool Co., Waltham, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Boring
Niles-Bement-Pond Co., New York.

Lathes, Brass
Pratt & Whitney Co., Hartford, Conn.
Springfield Mch. Tool Co., Springfield, O.

Lathes, Wood
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Letters, Pattern
Butler, A. G., N. Y. City.

Levels
Lufkin Rule Co., Saginaw, Mich.
Mass. Tool Co., Greenfield, Mass.
Stetson, R. O., Greenfield, Mass.

Lockers, Clothes
Merritt & Co., Philadelphia, Pa.

Lubricants
Besly & Co., Chas. H., Chicago, Ill.
Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators
Besly & Co., Chas. H., Chicago, Ill.
Gem Mfg. Co., Pittsburg, Pa.
Lunkenheimer Co., Cincinnati, O.

Lumber, Patternmakers'
Wuichet, Louis, Chicago, Ill.

Machinery Dealers
Baird Machy. Co., Pittsburg, Pa.
Chandler & Farquhar Co., Boston, Mass.
Fairbanks Co., New York.
Garvin Mch. Co., New York.
Hill, Clarke & Co., Boston, Mass.
McCabe, J. J., New York.
McDowell, Stocker Co., Chicago, Ill.

Machinery Dealers —*Cont'd*
Marshall & Huschart Mchry. Co., Chicago, Ill.
Motch & Merryweather Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pattison Machinery Co., W. M., Cleveland, O.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Vandyck Churchill Co., New York.
Wormer Mchy. Co., C. C., Detroit, Mich.

Machinists' Small Tools
Athol Mach. Co., Athol, Mass.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Boker & Co., Hermann, New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Durbrow & Hearne Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Lufkin Rule Co., Saginaw, Mich.
Mass. Tool Co., Greenfield, Mass.
Millers Falls Co., New York.
Montgomery & Co., New York.
Patterson, Gottfried & Hunter, Ltd., New York.
Pratt & Whitney Co., Hartford, Conn.
Sawyer Tool Mfg. Co., Fitchburg, Mass.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.
Stetson, R. O., Greenfield, Mass.
Wyke & Co., J., E. Boston, Mass.

Machinists' Supplies
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Durbrow & Hearne Mfg. Co., New York.
Hammacher, Schlemmer & Co., New York.
Montgomery & Co., New York.
Whitman & Barnes Mfg. Co., Chicago, Ill.

Magnets, Lifting
Electric Controller & Supply Co., Cleveland, O.

Mandrels, Expanding
Nicholson & Co., W. H., Wilkesbarre, Pa.
Western Tool & Mfg. Co., Springfield, O.

Mandrels, Solid
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Measuring Machines
Pratt & Whitney Co., Hartford, Conn.
Rogers, John M., Boat, Gage & Drill Works, Gloucester City, N. J.

Mechanical Draft
American Blower Co., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Mass.

Metal, Bearing
Besly & Co., Chas. H., Chicago, Ill.

Micrometer Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.
Syracuse Twist Drill Co., Syracuse, N. Y.

Milling Attachments
Adams Co., Dubuque, Iowa.
American Watch Tool Co., Waltham, Mass.
Becker-Brainard Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Mach. Co., Cincinnati, O.
Kempsmith Mfg. Co., Milwaukee, Wis.
Niles-Bement-Pond Co., New York.
Whitney Mfg. Co., Hartford, Ct.

United States Arsenal at Rock Island—VI.

BY F. A. STANLEY.

The first two engravings in this issue show additional views in the department where the trigger guards are machined, and a partial description of which was given in the preceding number. The first of these, Fig. 44, illustrates a battery of profilers of the same design as those shown in connection with the receiver shop. In the same row with these machines there are quite a number of hand millers, and one of them, with a work-holding fixture in position on its table, is clearly shown at the right of the first profiler in the line.

The second illustration, Fig. 45, is reproduced from a photograph taken at the other side of the room, and has as its most prominent feature a group of multiple-spindle machines for drilling the guards. Quite a number of shop boxes filled with these parts, which are now made in one piece with the magazine body, will be noticed alongside the drills, and on the tables of the latter are several of the jigs required for this class of work.

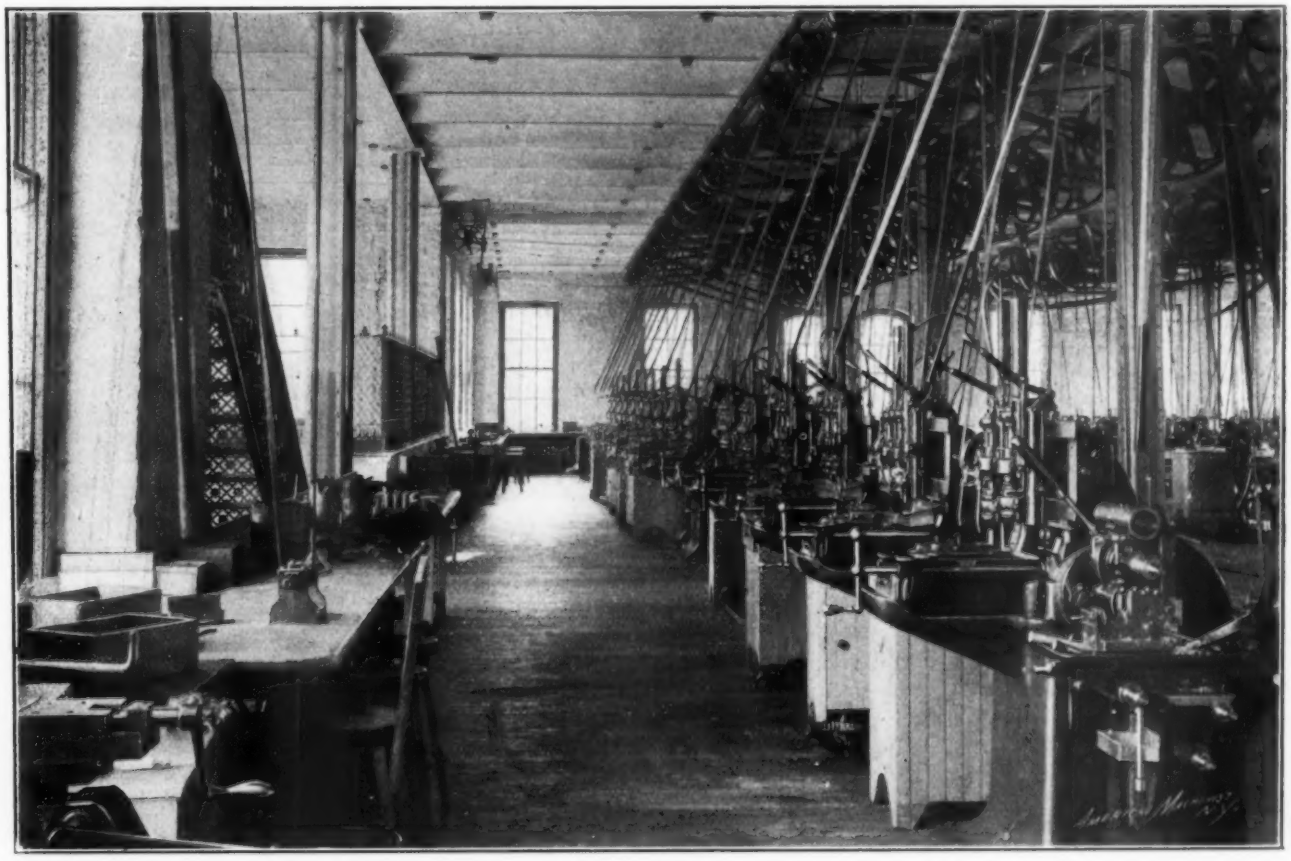


FIG. 44. PROFILERS USED ON MAGAZINE AND GUARD WORK.

THE BOLT SHOP.

Fig. 46 is a view in the bolt room, which is situated on the second floor in the east wing of the building, or directly over the receiver shop; and as the machinery in this department is in general quite similar to that in guard and receiver rooms, only the one illustration will be given. The work in the bolt shop is, however, quite as interesting as that in the other sections of shop B, for in finishing the breech bolt from the forging as it comes from the drop hammer, forty-eight distinct operations are necessary, most of which are performed by the aid of ingenious special tools and fixtures fitted to millers, profilers, screw machines and drills.

The major portion of this section of the article will be devoted to a description of shop D, in which are located the "stocking," filing, polishing and assembling shops, and the machine and tool department, which manufactures and keeps in order certain classes of tools used in the small-arms work. But before passing on to this building it should be noted that in the basement of shop B there is installed a hardening and tempering plant, consisting of gas furnaces, oil tanks, etc., for treating small parts manufactured in the departments on the floors above. These departments—like those yet to be described in shop D—have their own compartments for tools, and inspection rooms where all parts are examined preliminary to being sent to the assembling floor; and all branches of the establishment, as indicated by the illustration, are kept in a particularly neat and orderly manner. The floors are swept and scrubbed at frequent intervals; oily waste and rubbish are taken care of by numerous receptacles provided for the purpose; and, last but not least in this provision for cleanliness, practically every employee has a cuspidor, which is cast in the arsenal foundry.

ARRANGEMENT OF DEPARTMENTS IN SHOP D.

Of the departments referred to above as located in shop D, the toolroom and machine shop and the assembling and polishing rooms are on the first floor. Here also are the general foreman's headquarters, facing Main avenue, and a laboratory for testing material. On the second floor are the filing and stocking shops, with inspection rooms in the front portion of the building. And in the basement there are facilities for hardening and tempering small tools, machines for cutting off stock, stones for grinding bayonets, etc., and plumbing, pipe-fitting and repair shops. Just at present the busiest part of the shop is the toolroom; for as yet the small arms work is not under full swing, tho it will be in a very few weeks, by which time it is expected that the assembling department will be able to put up the stipulated quantity of work—125 complete rifles per day.

MAKING GUN STOCKS.

The first view to be shown in connection with the interior of shop D is one in the stocking department, where the gun stock

is cut out and then turned into shape. This illustration, Fig. 47, shows in the foreground several special machines (of Garvin construction) for turning the butt of the stock, the work being chucked as shown, at the front of the machine carriage and driven in unison with a metal model or form mounted at the rear. A circular cutter head is mounted upon a spindle supported independently between the stock and the model and driven at the high speed necessary in wood-working operations; and the movements to and fro of the cutter support and cutter to shape the stock as the carriage is fed along are controlled by a wheel or roll of the same diameter as the cutter, which roll is always kept in contact with the metal form at the back of the carriage.

This is of course the principle of the Blanchard lathe, with which most readers are familiar. There are a number of these butt turners—roughers and finishers—and other machines of the same type (such as "tip" and "band" and "between band" turners) for machining the rest of the stock. Then there are several tools—of the same make as the above—of the profiler class, tho made especially for wood-working operations, and in which by the aid of special fixtures the stock is held while it is grooved to form a bed for the rifle barrel, cut out to bed the receiver, guard, etc., and slotted to receive various other members, these operations all being accurately performed by the aid of metal formers shaped like the finished gun stock and guiding the cutter in precisely the same way as if the work being profiled were of metal instead of wood. Still other machines bore the butt of the stock to lighten it, form a pocket for the tubular oiler issued with each rifle, and form the bed at the front of the stock for the rod bayonet. And of course there are several saw benches and other machines common to wood-working shops.

All machinery in this room is connected with an exhaust system for carrying away shavings and chips. The fans for this work are in the basement, and the shavings as drawn away from the cutters follow piping carried under the west wing of shop F to the boiler-house in the courtyard of that building.

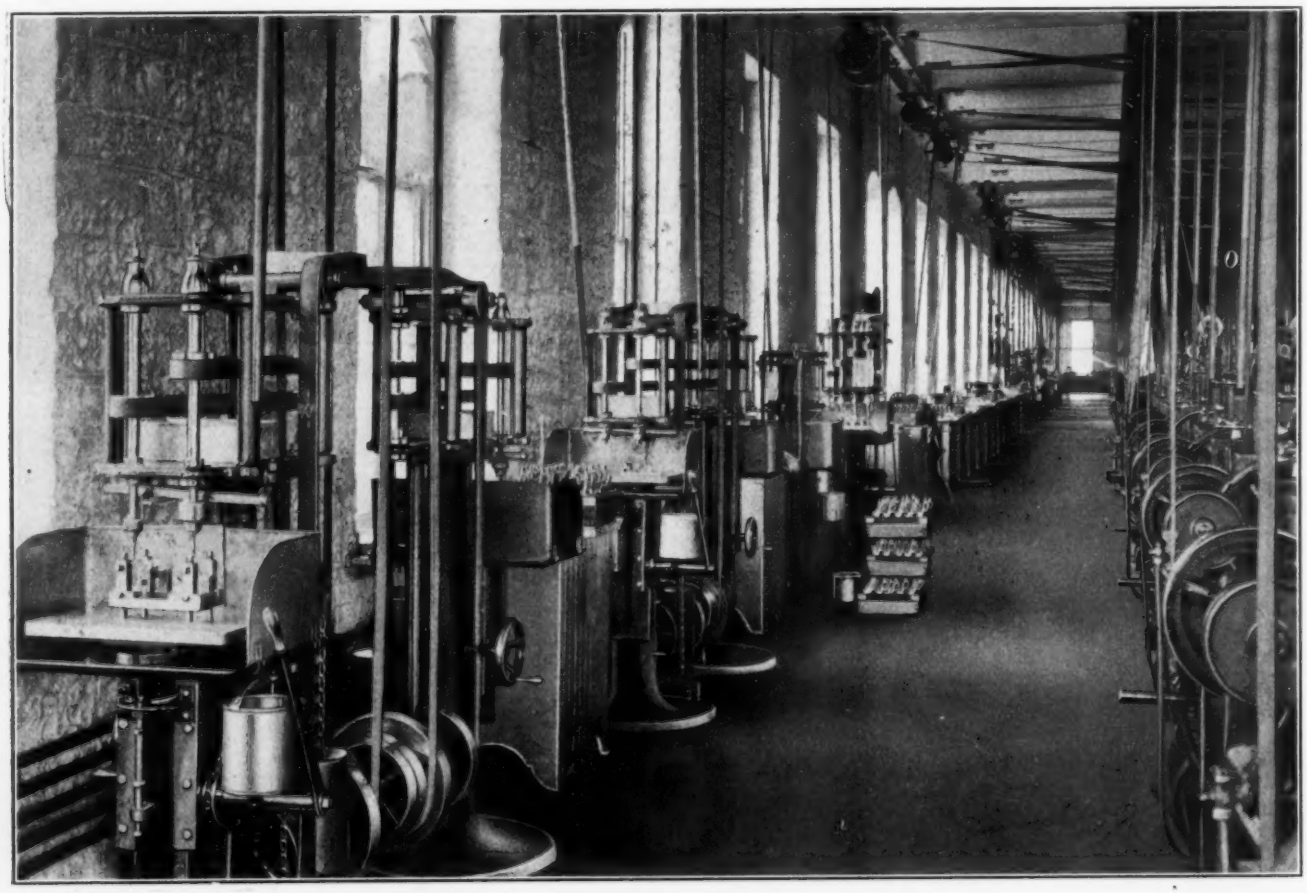


FIG. 45. A GROUP OF MAGAZINE AND GUARD DRILLERS.

THE POLISHING ROOM.

Fig. 48 is a view down one side of the polishing room and gives an excellent idea of the equipment of jacks, etc.; and at the left in the engraving will be noticed a very neat and convenient rack, made from piping, for holding the various sizes of emery wheels. Like the corresponding department in Arsenal Row, this room has an efficient dust-collecting system for keeping the air free from grit and metal particles.

MACHINE SHOP AND TOOL DEPARTMENT.

The entire first floor in the east wing is taken up by the various branches of tool and machine work essential to the keeping up of the manufacturing equipment in Armory Row. Along the east side of the room extends a row of planers, shapers, drills, etc., utilized in die-making and other operations. Across the way is a milling department for cutters, reamers, taps and other tools. Farther up the room is the tool stores, beyond which is a group of small lathes for tool work; and at the north end of the room is the grinding department, containing several cutter and reamer grinders and Brown & Sharpe universal and surface grinders.

Fig. 49 gives a general view in the tool department, showing, among other features, a group of Brown & Sharpe millers in the partially enclosed space to the left, with the tool stores in the wire-enclosed compartment beyond. The piping shown overhead in this photograph is a part of the shaving collecting system already alluded to, which leads from the stocking shop on the floor above to the basement and thence to the steam-heating plant in the courtyard of the next building. Two other interesting views are given in Figs. 50 and 51: in the former a number of Pratt & Whitney 10-inch toolmakers' lathes being shown, and in the latter a group of shapers, millers, etc.

TESTING MACHINES.

The final view in the series illustrating the different sections in the small arms plant is Fig. 52, which shows the testing

FIG. 46. VIEW IN BOLT DEPARTMENT.

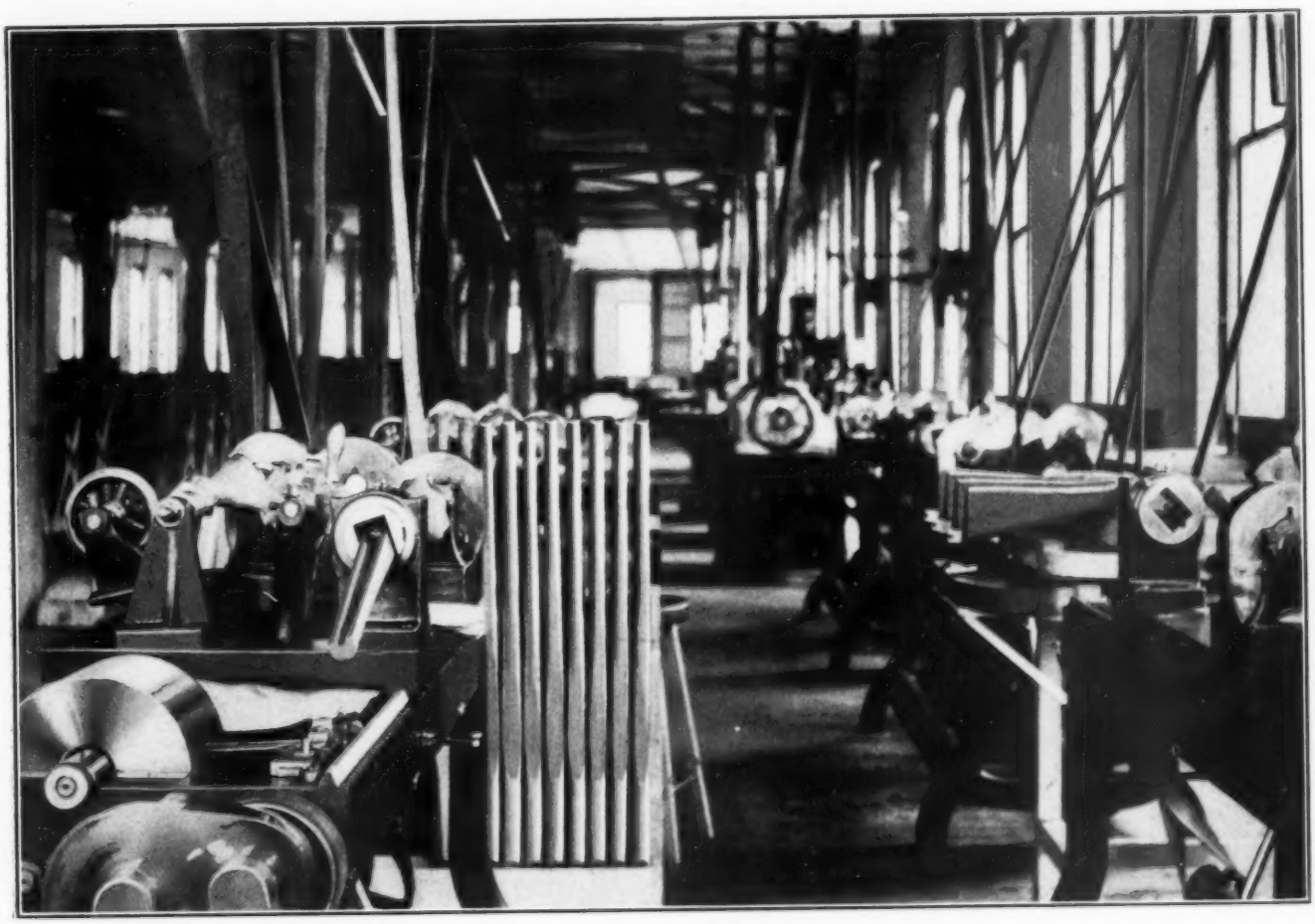


FIG. 47. VIEW IN "STOCKING" SHOP.

room, with a Riehle 100,000-pound automatic and autographic testing machine at the rear, while in the foreground will be seen a portion of a hand machine of the same capacity, built by General Rodman at the time he commanded the arsenal. The latter machine is used chiefly in testing the stiffness of hollow axles of the type used in the new field gun equipment and a number of which are shown piled up on the floor about the machine.

Enough illustrations have been presented in the sections of this article devoted to Armory Row to give the reader an adequate conception of the small arms plant at Rock Island Arsenal. The engravings have been permitted to tell much of their own story, and in depicting some of the principal departments have brought out various points not mentioned at all or merely alluded to in the text. One of the most important of these, as emphasized in several of the general views, is that while the plant has at present an extensive machine equipment, this may be quite largely increased, whenever necessary, without a general rearrangement of the present installation. In other words, there is still considerable available space in the three shops operated in the row; and, as two entire buildings there are as yet unoccupied by machinery, it will be seen that there are great possibilities for future expansion.

The new magazine rifle whose manufacture is being carried on simultaneously at Springfield and Rock Island will be illustrated in the next article in this series.

FIG. 48. VIEW IN POLISHING ROOM.

Legal Notes.

BY E. P. BUFFET.

WAIVER OF CONDITION AS TO DELIVERY.

The case Austin Manufacturing Company vs. Snouffer was based on a contention that the company had failed to ship a stone crusher on the agreed date, May 23, and that in consequence the purchaser resisted payment, whereupon the company sued to recover the balance due on the price and to foreclose a mechanic's lien therefor. It appears that the delay had been caused by the company's inability to procure certain steel castings made by another concern and that the crusher was in fact shipped June 5. On June 3 the company had telegraphed Snouffer asking whether it should ship the crusher or return the payment made thereon, and he had answered, "Ship at once," which was accordingly done and the crusher set up, there being no intimation by him that he would claim damages. Under the facts of the case, of which his order to ship is a strong one, the Supreme Court of Iowa considers that there was a waiver of the condition as to time of delivery and affirms a judgment of the District Court in favor of the Austin Company. Further, the appeal court does not believe that the purchaser suffered damage because of the delay. (102 N. W. Rep., 128.)

CASE WHERE WAIVER OF A CONDITION WAS NOT HELD.

This was based on a contract between certain scrap dealers and a machine and foundry company of Bay City, Mich., in the following form:

"We propose to furnish you all the scrap material of the following grades which we receive for the period of sixty days ensuing from this date: No. 1 cast scrap at $18 per net ton, stove plate at $14 per net ton."

It was signed for the company by its president and general manager as "Accepted." About the form of this written contract there appears to have been no dispute. Questions, however, arose concerning its modification by extrinsic circumstances.

The foundry company offered testimony tending to show that after the contract was made there had been a drop of something like $4 per ton in scrap and that the dealers thereupon began to search it out in unusual quantities and to buy it up from wholesalers. Upon discovery of these facts, it is claimed, the company refused to receive more. Later on, however, its manager telephoned to the dealers to "bring on their iron" or used some expression to that effect. After a further

FIG. 49. VIEW IN TOOL DEPARTMENT.

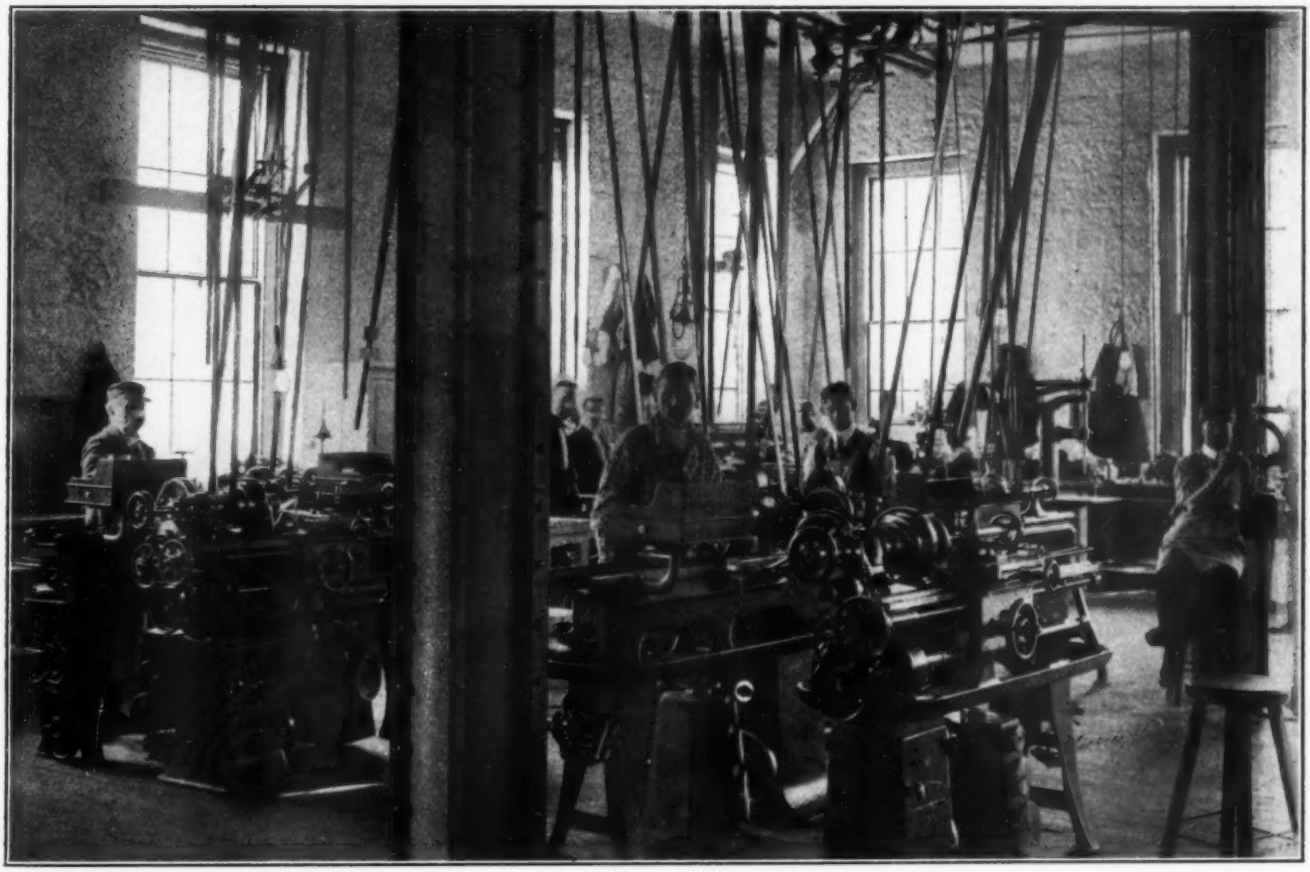


FIG. 50. A CORNER OF THE TOOLROOM.

quantity had been delivered, the company declined to accept any more. In consequence, the present action was brought against it by the dealers.

The defendant (foundry company) offered to show that the written contract was struck off in a hurry to fix the price; that the real contract was oral and stipulated that the amount of scrap delivered should not exceed that furnished during the preceding sixty days. The trial court refused to receive this testimony because of the well-known rule that parol evidence shall not be admitted to contradict the terms of a valid written instrument.

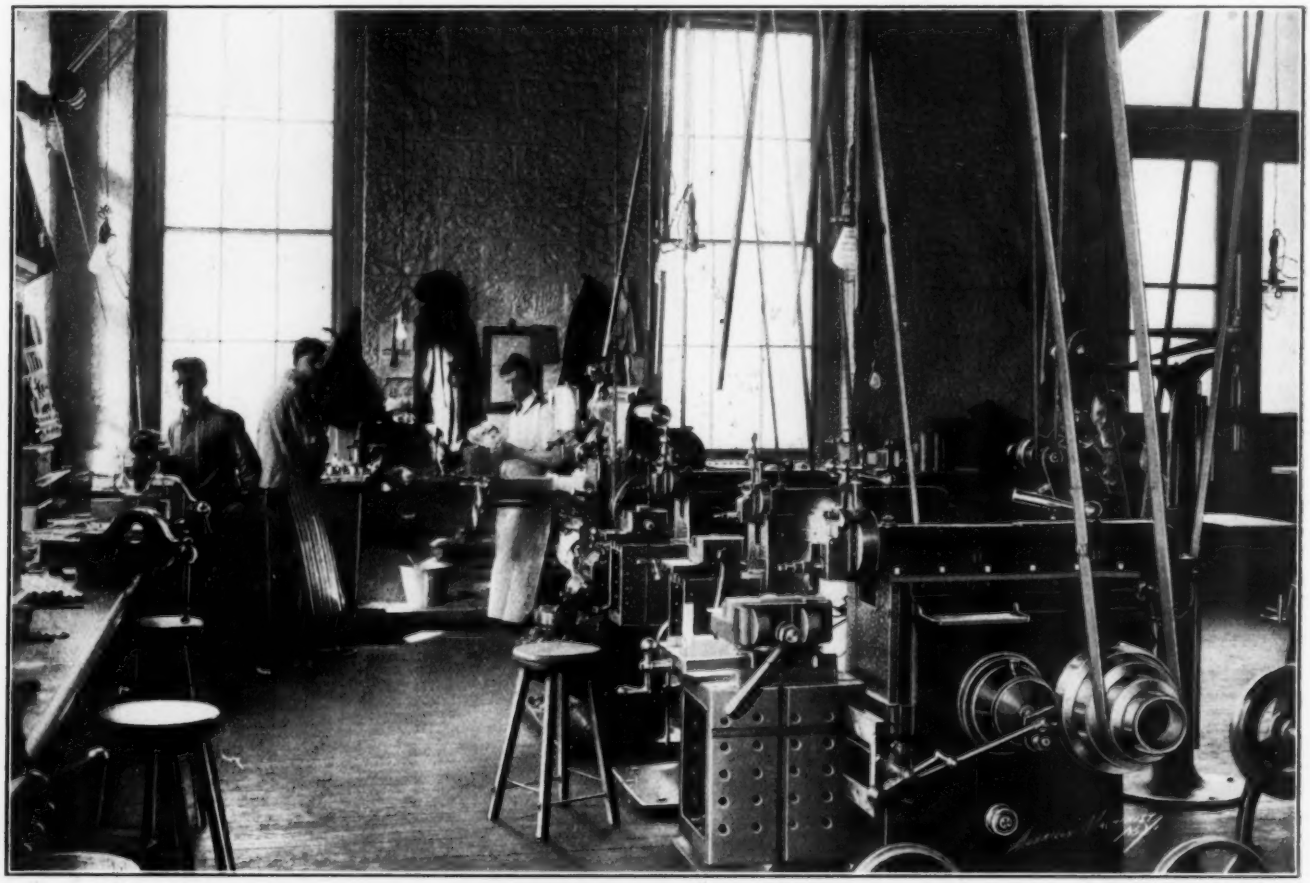


FIG. 51. A CORNER OF THE TOOLROOM.

The Supreme Court of Michigan, on appeal, holds that to this extent its ruling was correct.

While, however, it was not competent to show that there was a contemporaneous parol agreement which varied the terms of the written contract, it was permissible to show the general character and business of the parties to enable the jury to learn what was meant by the expression "all of the scrap material of the following grades which we may receive for the period of sixty days." It was evident that the writing had been made with reference to the business in which the parties were engaged and that the undertaking was to contract for such scrap as would be accumulated in such business as there conducted. The trial judge so construed the contract, in effect, and the appeal court holds that this was right.

The trial court, however, held that the terms of the contract, which, as thus far interpreted, would stand in favor of the foundry company, had been waived by it in telephoning to the scrap dealers to bring on their iron. To this the appeal court does not agree. The reasons given for the reversal are a little hard to follow, but these considerations seem to be involved in them: The telephone message did not constitute a waiver of right to rescind a contract on the ground of fraud, by delay or by treating the contract as binding. The foundry company claims that it has now accepted all the iron it was bound to under the contract. If after first stopping delivery it was doubtful on this point and chose to call for more iron it waived merely the right to stand on its first refusal, not the right to stand on the second. Nor was the telephone message a new contract; if such, it would have been void under the statute of frauds.

(For the benefit of the lay reader it may be explained that the "statute of frauds" is a famous old English one which has been embodied, with more or less modification, in the laws of this country and which requires contracts of certain kinds to be in writing. The use of the word "fraud" here is not to be confused with its employment earlier in the paragraph.)

(101 N. W. Rep., 804.)

Ingenious War Correspondence.

In a recent interview with Gen. Stoessel, obtained in Port Said, the correspondent of *The London Standard* reports that the defenders of Port Arthur made use of Japanese shells which, falling on soft ground, did not explode. These shells the Russians were careful to collect, and to fire back whence they came. The explanation is somewhat curious. The mortars used by the Japanese were supplied by Messrs. Armstrong, and, like all mortars from those works, were rifled from right to left. The Russian mortars were rifled from left to right, and consequently it was possible to use the Japanese shell twice, which would have been out of the question had the rifling been identical.

The ordinary watch cannot be used on submarine boats, but a special watch, the construction of which conforms with the conditions within the underwater craft, is necessary. These watches cost from $75 to $100. None are manufactured in the United States as yet, for watchmakers are loth to invest for the first order of them. —*Popular Mechanics.*

We wonder why. The ordinary watch is good in a balloon, in a coal mine and in a bridge foundation caisson. An ordinary cigar is not smokable in a submarine boat. Smoking will not be possible until we have a cigar which will not vitiate the air.

The Ultimate Limit of Speed in Gas Engines.

BY HERBERT L. TOWLE.

In view of the rapid increase in piston speed and speed of revolutions, which has marked the development of the automobile motor, and the impending increase of nearly or quite the same amount in gasoline marine engines, the question must frequently be discussed, what is the ultimate limit of speed of these motors? By ultimate limit of speed here is not meant the very highest speed at which any motor can possibly run, but rather the limit imposed by engineering conditions for steady and continuous running. As it is only in the above classes of motors (and, one might add, in flying-machine motors) that the highest possible speed seems likely to be sought, stationary motors may here be left out of consideration.

If one were to canvass the makers of automobiles and launch motors, especially perhaps the latter, and were to ask each for his reasons for not aiming at a higher speed than that specified in his catalog, an interesting variety of statements would undoubtedly be brought forth. One builder, for example, would say that any motor (including his own) would be shaken to pieces by a higher speed. Another would say that higher speed would not give more power, as the torque would fall off faster than the speed increased; and, if pressed for the reason why some other builder was able to run his motor faster, he would possibly reply with furtive hints about a pernicious practise of overrating horse-power. Still another would declare that the higher speed caused the piston to "run away from" the flame. Another might claim that faster running overheated everything, and induced premature ignition of the charge. Probably, however, the largest number would say that higher speed would make the engine wear out too fast in piston rings, cylinders, or bearings, or all three, and that it is cheaper to run the engine slower and keep it longer.

Now, every one of the builders above supposed may have stated his own genuine experience; and yet, if his rated piston speeds were less than 1,000 feet per minute, there is fair reason for questioning if the obstacles he enumerated were really, in the last analysis, insuperable. In other words, he may have found his own limit, but certainly not *the* limit of speed, in an engineering sense. That this is the case is indicated by the large number of high-grade automobile motors whose "normal" piston speed—a rather indefinite term, it must be admitted—is fully 900 feet per minute, and which, when accelerated for racing, reach 1,200, 1,400, even 1,500 feet per minute for hours or even days at a time.

It is freely admitted that the racing automobile requires a thorough overhauling after every long race, and the wearing parts of the motor generally get their share of attention on such occasions. The highest skill of the best engineers has not been able to change this fact, which simply means that our present ability to get the charge into and out of the cylinders, and to burn it, is ahead of our ability to make the motor "stand up." The real questions then are two: First, what is the highest speed in an engineering sense possible; and, when this highest speed has been determined, with what degree of closeness can the normal running speeds of commercial motors be brought up to it? It is of course evident that to whatever extent engineering skill is able to remove the practical obstacles in the way of high speeds, the high speed will be adopted in preference to the low, since it means a greater power output for the same, or nearly the same, first cost of engine and without increase of weight.

The above noted obstacles to high motor speed may be summarized as follows: (1) Vibration; (2) wear of piston, rings, and bearings; (3) sluggish flame propagation and decreased torque; (4) overheating.

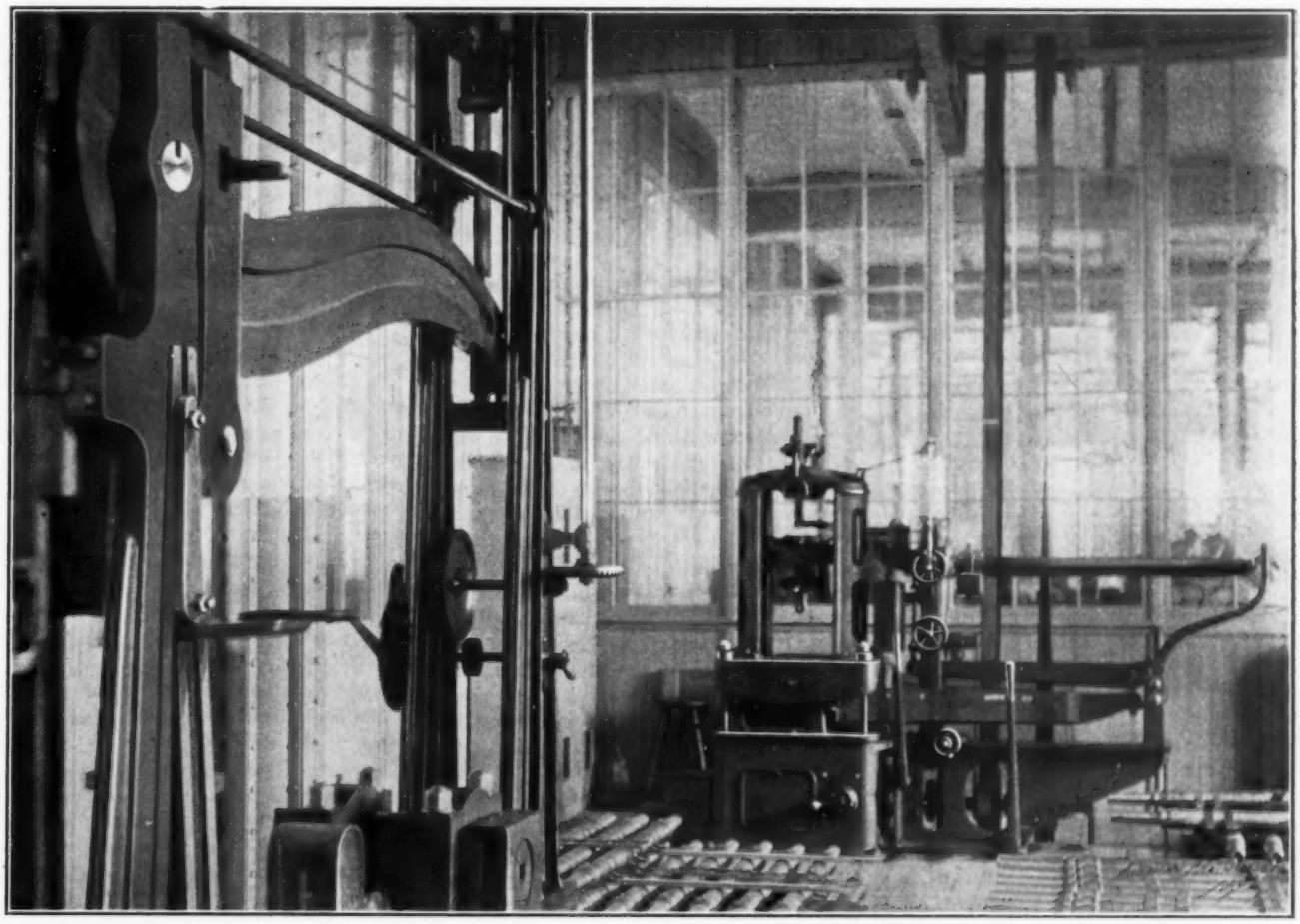


FIG. 52. TESTING MACHINES.

General wear and tear would no doubt be added as a fifth by many builders. It is, however, partly covered by (1), (2) and (4) above; but it will be referred to again in a later paragraph.

Altho the first four factors are all serious enough to demand careful consideration, I do not think that "in the present state of the art" we are justified in pronouncing any one of them, or even all together, sufficient to fix definitely the ultimate limit of speed. Vibration has already been amply demonstrated to be negligible in vertical motors of four or more cylinders, and, for moderate powers, not of serious moment even with three cylinders, except perhaps at certain critical speeds, when the vibration period of the motor happens to synchronize with that of the springs on which it is mounted, or the hull in which it is placed.

Ordinary wear is simply a question of bearing surfaces, proper materials, and efficient lubrication. The last is indeed a difficult problem, and many builders, especially of the older type of launch motors, do not know how to lubricate effectively such parts as the crank and wrist pins. Still, the most efficient lubrication possible is by no means so common as it some day will be, at least where small engines are concerned. As to the piston and its rings, there is no way to save them from wear, but we may be very sure that if there were no other objections to high speed the purchaser would cheerfully pay the cost of new rings and an occasional new set of pistons, and of the necessary reboring of the cylinders, for the sake of getting, say, 15 or 20 horse-power, instead of 10, from a given size of engine.

Rapid flame propagation may be secured by an intense spark, and, if necessary, by igniting at two or more points within the cylinder. Even in the fastest automobile motors multiple ignition is hardly considered necessary to-day, and there is no immediate prospect of our being compelled to exhaust the possibilities in this direction. It is indeed necessary to use high compression, and a very good carburetter, if high piston speeds are aimed at, but each year sees carburetters improved, and high compression is no longer the bugbear of designers that it used to be. Compressions of 90 or 100 pounds per square inch are now used successfully in many automobile engines.

Overheating of the piston and of parts projecting into the combustion space is undoubtedly a frequent factor in restricting speed. Its influence, however, is rather indirect, since its effect is to necessitate a moderate compression, with which high speed is hardly possible. It might be imagined that this factor would be a serious one, but it has not been found so, at least with cylinders up to 8 inches in bore, and it seems probable to me that piston diameters of 9 or 10 inches can successfully be used with high compression in gasoline engines, before recourse must be had to water injection or other devices to prevent premature ignition. One maker, at least, now casts his pistons with internal spines, designed to assist the dispersion of heat. I would prefer a suitable number of ribs to assist in conveying the heat to the piston walls; but, as a matter of fact, automobile motor pistons are made up to 5 or 6 inches in diameter with very thin heads and scanty ribs, without trouble from overheating. The reason seems to be that, so long as the mean temperature of the gases in contact with the piston for the four strokes of the cycle does not exceed certain limits the piston is not likely to heat to the point of igniting the gases spontaneously.

The problem of getting the fresh charge into, and the burned gases out of, the cylinder with sufficient rapidity is certainly one that calls for a good deal of ingenuity. Various makers have used multiple inlet valves, and in some cases also multiple exhaust valves, an illustration in point being the eight-cylinder engine of the "Onontio," built (the engine) by James Craig, Jr., of New York. Each cylinder of this engine has two inlet and two exhaust valves opening directly into the top of the cylinder head. The valves are operated from cams by bell cranks, and the exhaust valves are timed so that one opens a little before the other, thus relieving the pressure on the second valve. Some time the designers will find a limit to the size or number of their valves, but just where that limit will be found seems to be a question more of ingenuity than of mathematics, and to attempt now to place it seems hardly reasonable.

There is, nevertheless a limit to engine speed, which, tho it cannot be rigidly fixed for all future time, is at least mathematically calculable for any given case, and can be approximately fixed for "the present state of the art." It depends on the weight of the reciprocating parts, and may be stated by saying that the inertia force of these parts—piston, wrist-pin and connecting rod—at the upper or outer end of their stroke, must in no case be allowed to exceed the pressure due to compression in the cylinder. The importance of this inertia force at high speeds is well known to designers of high-speed steam engines, and perhaps to the majority also of the builders of high-speed gas engines, but I have not happened to see its influence graphically treated for the highest speeds at which a motor may safely be run.

At the beginning of any stroke, this force acts as a drag on the crank-pin, and at the end of the stroke it tends to hasten it; and the intensity of this retarding or assisting force is proportional to the rate of change in the piston's velocity. That rate of change has its maximum values at the ends of the stroke, when the velocity itself is (for an instant) zero, a d is zero when the connecting rod and the crank are at right angles. If the piston were connected to the crank-pin by a Scotch yoke, this inertia would be the same at both ends of the stroke, but in consequence of the angularity of the connecting rod it is greater at that end of the stroke when the piston is farthest from the shaft.

If we were to neglect the angularity of the connecting rod, the inertia force at the ends of the stroke would be exactly equal to the centrifugal force which a body of the same weight as the reciprocating parts would exert if its mass were concentrated at the center of the crank-pin. Taking the connecting rod into consideration, the formula actually to be used is the following:

$$F = F_0 \left(\cos. w + \frac{r}{l} \cos. 2w\right),$$

in which

F = inertia force parallel to cylinder axis,
F_0 = centrifugal force of same mass at center of crank-pin.
w = crank angle from top of stroke (a vertical engine being supposed),
r = crank radius,
l = connecting rod length, center to center.

If r be in inches,

$$F_0 = 0.0000285\ W\ r\ N^2$$

in which

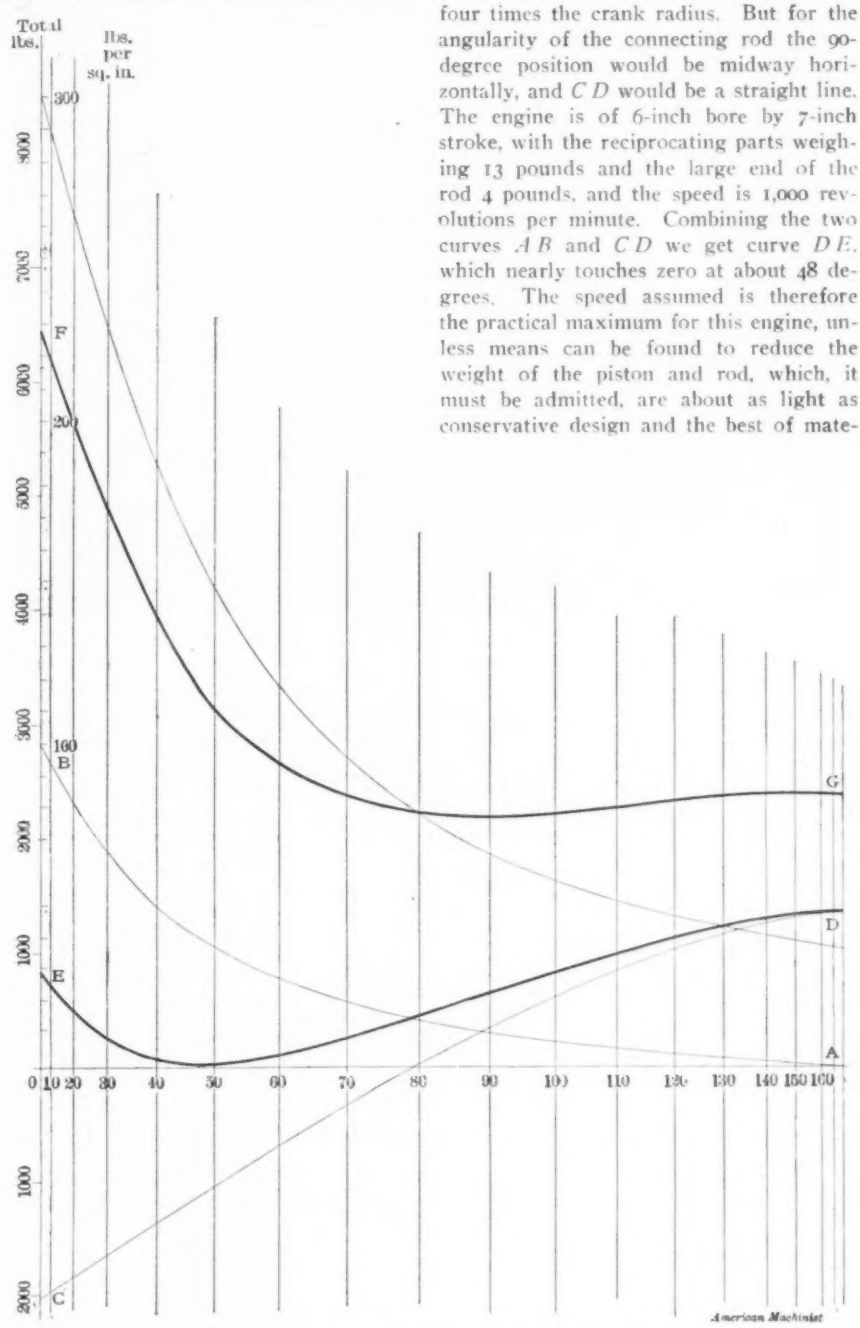
W = weight of revolving parts in pounds,
N = revolutions per minute.

To get the total axial force on the crank pin, which is the thing desired, we must add the axial component of the centrifugal force of the large end of the rod. For this pupose the weight of the rod may be apportioned between its small and large ends by weighing it on two scales, with the center of each end supported and the rod lying horizontally. The small end will then be included with the reciprocating parts and the large end will be treated as a revolving part. The axial component of the centrifugal force of the large end will be the centrifugal force multiplied by the cosine of the crank angle w.

If the reader familiar with gas engines will take the weights of the piston, wrist-pin and rod of any gas engine with which he is familiar and will work out the above calculations for a piston speed of 1,000 feet per minute, he will perhaps be surprised to find how close the sum of these forces comes to equaling the total pressure of compression on the piston at the end of the compression stroke. Evidently, the reason for not allowing these forces to exceed the compression is that, if they do, the connecting rod will be lifted till the slack of the crank-pin bearing is taken up, and when the explosion comes it will drive the rod down again on the pin, producing a more or less destructive knock. Evidently, the looser the bearing the more violent will be the knock, and the sooner will the bearing succumb.

It might be supposed that if the compression were sufficient to hold the rod down on the crank-pin at the extreme end of the stroke, it would be more than sufficient for this purpose during the whole compression stroke, but this is not the case

if the terminal compression is high. The accompanying diagram shows a theoretical indicator card with a compression of 100 pounds gage, instantaneous ignition, and an explosion pressure of 300 pounds gage. It gives a mean effective pressure of about 78 pounds, which is by no means excessive, as a first-class automobile engine will give 80 to 90 pounds. It is used in preference to an actual indicator card, for the reason that the latter is nearly impossible to get at high speeds, and is subject to numerous variations according to the mixture and the time of ignition, which are eliminated in the ideal card. Practically the compression curve $A B$ is the one of chief interest, and the actual curve would differ from the ideal only in beginning to rise above atmospheric pressure a little later in the compression stroke, and in rounding smoothly into the explosion curve, owing to the spark being advanced for high speed. At the critical point of the curve, viz., about 45 to 50 degrees from the top center, the curve would be practically the same as drawn.



THE ULTIMATE LIMIT OF SPEED IN GAS ENGINES.

The curve $C D$ is the inertia curve plotted for the several crank angles shown, the connecting rod being supposed to be four times the crank radius. But for the angularity of the connecting rod the 90-degree position would be midway horizontally, and $C D$ would be a straight line. The engine is of 6-inch bore by 7-inch stroke, with the reciprocating parts weighing 13 pounds and the large end of the rod 4 pounds, and the speed is 1,000 revolutions per minute. Combining the two curves $A B$ and $C D$ we get curve $D E$, which nearly touches zero at about 48 degrees. The speed assumed is therefore the practical maximum for this engine, unless means can be found to reduce the weight of the piston and rod, which, it must be admitted, are about as light as conservative design and the best of materials would justify. Curve $F G$ is the expansion curve combined with the inertia curve.

A similar calculation for a 4x5-inch engine in which the reciprocating parts weigh 6 pounds, and the large end of the rod 1½ pounds, shows that with a speed of 1,200 revolutions per minute the inertia force and compression are nearly equal at 50 degrees. As this speed is frequently exceeded in automobile motors, the reason for the abnormally light design of the pistons and rods of engines of the De Dion type is at once manifest. The factor of safety in these parts is hardly large enough to be worth considering, but it is only the paucity of this factor that makes such speeds practicable on any terms. These motors have at least shown that by using a piston length only equal to the diameter with semi-steel for material, and the very thinnest and most accurate of castings, a piston for a bore of 100 millimeters can be made to weigh only a trifle over 2 pounds, and the connecting rod and wrist pin will weigh less than as much again. We may therefore say that for ordinary launch engines the limit of speed is from 1,200 revolutions per minute for small engines down to about 800 revolutions per minute for the largest.

The question now deserves consideration: Is there any good reason why this practical maximum of speed cannot be made the normal speed for continuous running? Personally, I think that where pleasure craft are concerned the time when this will be the case is not far distant. It has been shown above that there is no real obstacle in the way save that of maintaining the bearing surfaces at these speeds; but that obstacle itself is more apparent than real, and is due, in my belief, largely to defective or old-fashioned methods of lubrication. The old idea of drop-by-drop lubrication, while perfectly adequate so long as speeds were low, must give place in modern engines to the principle of a continuous stream of oil, fed to every important bearing, collected, settled or filtered, and used again. This principle is already well exemplified in high-speed steam engines, turbines, and electrical machinery; and it is employed to a limited extent in automobile engines, but nothing like as generally as it deserves to be, and easily can be, applied. The crank-pin, in particular, is in very few engines lubricated as well as it might be, and in most automobile motors oil is fed to it at what I regard as diametrically the wrong point—namely, the top or pressure side of the crank-pin bearing, instead of the slack or cap side.

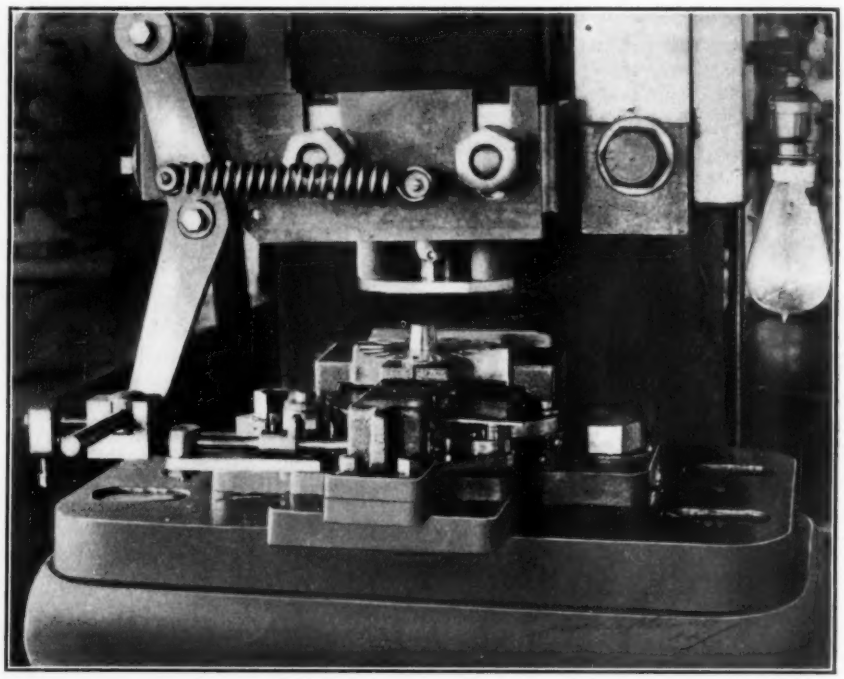
The fact is perhaps significant that ball bearings of the type first made popular by their use in the Mercedes automobiles, and now extensively used abroad in automobile transmission and wheel bearings, have this year been applied to the crank-shafts of three separate makes of automobile motors—the Mercedes 70 horse-power, the Hotchkiss, and the Charron, Girardot, and Voigt. These bearings seem hardly likely to be applied to crank-pins, but if they prove successful as main shaft bearings they will constitute a notable improvement in high-speed gas engines of moderate size; and, of course, their use will considerably simplify the lubrication problem.

An Armature Disk Notching Attachment.

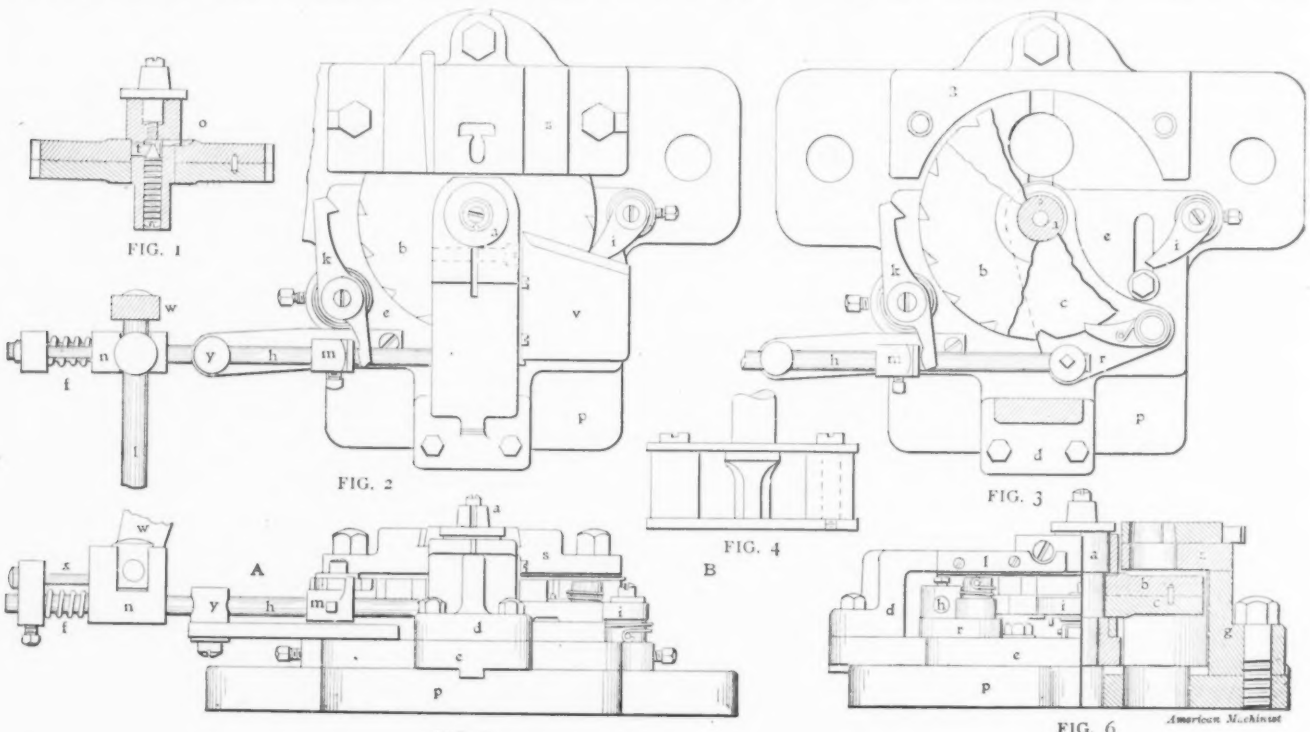
BY H. B. M'CABE.

The drawings show an attachment which I have designed and which, as the photograph shows, is in actual use and is suitable for any punching press with sufficient space between the slide and bolster plate to receive it. It can be easily and quickly adjusted for any diameter of disk between 3 and 14 inches, and can be built for about $75. This rig was made and used in a shop making a variety of electrical apparatus and building twelve different sizes of armatures, none of which were made in lots of over fifty, and it gave good satisfaction from the start. The dies were made of Novo steel 2 inches wide and ½ inch thick. The photograph shows the general appearance of the attachment with a disk in place and will make clear the means of transmitting the motion from the slide of the press to the index spindle of the attachment. On the back side and the upper end of the long lever at the left is a stud and a roller which is held against the inclined edge of the templet by the coil spring shown. This templet is about ⅜ inch thick, is held under the clamping nuts on the slide and is slotted for adjustment. As the slide moves up and down a vibrating motion is thus given to the lever.

Referring now to the drawing, Fig. 2 is a plan, Fig. 5 a front elevation, Fig. 3 a plan with section on line *A B*, Fig. 5; Fig. 6 is an end elevation with the portion back of the spindle center in section. The vertical spindle *a* is journaled at its lower end in the plate *c* and at its upper end in bracket *d*. It carries two disk-wheels *b* and *c* dowel-pinned to rotate together, Fig. 6, the upper one, being keyed to the spindle and each having ratchet teeth, these pointing in opposite directions, as shown in Fig. 3. The upper wheel *b* may be regarded as the index wheel and the lower one *c* as a ratchet wheel for imparting the movement to the index wheel. The movement to the ratchet is transmitted thru the pawl-carrying rocker *r* and rod *h* from the lever shown in the photograph and also at *w*, Figs. 2 and 5. The rocker *r* does not turn directly on the spindle *a*, but on a concentric boss on plate *e* surrounding the journal. This plate *e* carries a pawl *i* to prevent back movement of the ratchet, and also a stop pawl *k* so placed that it engages the teeth of the index wheel *b*, being normally held into its notches by a spring and withdrawn therefrom by the adjustable tappet *m* coming in contact with its projecting finger on the return stroke of rod *h*, which withdraws it sufficiently to clear the teeth of the wheel and enough more to allow the next forward stroke to rotate the wheel



AN ARMATURE DISK NOTCHING ATTACHMENT.



ARMATURE DISK NOTCHING ATTACHMENT.

a little to the right before it is let back into position to again engage, thus leaving the spring to force it into place in the next succeeding notch when it arrives. The radial face of the notch is brought up against the stop *k* with some pressure, and to insure this being always constant the index is given a tendency to rotate a little too far by adjusting the templet above on the slide to give the rod *h* a movement somewhat greater than required to move the index one division, the surplus movement being taken up by the coil spring *f*. The block *n* is slidingly mounted on rod *h* for this purpose, and is retained in its vertical position by the headed pin *x* attached securely to *n* and sliding freely thru the stationary block *y*. Block *n* has a universal joint connection to the lever *w* thru the long pin *l*.

The die is keyed in a machinery steel shoe *s* adjustably clamped to its support *g* which is permanently secured to the base plate *p*. The photograph shows the die held a little differently, the way shown in the drawing being a later development. It may be noted that the entire indexing mechanism is contained on the plate *c*, and this is provided with a tongue fitting a groove in the base plate *p*, and is also slotted for the clamping screw, thereby allowing for an adjustment to and from the die for different diameters of disks to be notched.

Fig. 5 is a sectional view of the spindle *a*. The pin *o* fits a radial keyseat in the upper wheel. The pin *t* fits freely in a radial hole and can be forced outwardly by turning the vertical headless screw shown, thereby clamping the wheel securely to the spindle. The upper end is bored to receive the shanks of hardened steel heads kept in stock for the different sizes of shaft holes in the disks to be notched. These are held in place by means of a screw thru the center and dowel pin, as shown.

To lead oil to the lower journal a small hole should be drilled down from the top, coming out at the lower shoulder in some place not to interfere with the key and clamping pin described.

The punch, Fig. 4, is provided with a stripper plate and two rubber cylinders for actuating springs.

When the rig is set for the larger sizes, above 6 inches in diameter, the slugs from the die will fall directly thru, but when set as shown for a small size they fall on the index wheel and are carried around and collected by the knife-edged plate *v* and can be brushed off as they accumulate.

It will be noticed that the opening in the die is T-shaped, thus square or irregular shaped disks with the shaft hole punched in them can be notched and trimmed off round at the same time. The trimmings may be brushed off with a pine stick without stopping the press.

A foreman should make a study of the use of words which will stimulate without stinging too much.

Things That Are Usually Wrong —VIII.

BY JOHN E. SWEET.

No reasoning can make it out that the place for the support of an ordinary sized lathe bed at the tailstock end of the lathe is at the end. If placed a considerable distance from the end, and the tailstock is at the end, it is better supported than when in the middle of the present style of lathes and also better supported at all other points. At the headstock end it is quite a different matter, as the headstock is always fixed and is usually heavier loaded, exclusive of its own greater weight. Where the headstock end support is a closet, there is no way to make it look right except to have the closet the same width as the headstock is long.

In the case of a planing machine bed up to 12 or 15 feet in length there is no reason for having three pairs of supports. Unless the foundation is absolutely unyielding—a thing that is more rare than the other kind—the three or more pairs of supports are especially bad, and to attempt to hold the foundation true with a frail planer bed is foolish. The distance between the supports in Fig. 34 is no greater than in 35, and as in no case would the center of the load in planing overhang the supports more than a slight distance the style 34 is quite as well supported as the other, and when the iron in the legs and the work to fit them are taken into account, if they were all put into the casting the bed could be brought down to the floor as in Fig. 36, greatly improving the structure.

Another improvement is to use the iron usually put in the cross girts—which do not stiffen the bed in any way to any great extent—and use it in bottom and top webs, making the thing a four-sided box, which is from four to a dozen times stiffer in all directions, and then rest the whole thing on three points, one under the back of each housing and one under the middle toward the other end. The whole thing, including patterns and setting, will cost no (or very little) more and be four times better than present practise.

If the bed is supported at the same points when it is planed and fitted up, no attention or skill is required in the erection—just set it anywhere and on anything solid, and that is all that need be, or can be, done.

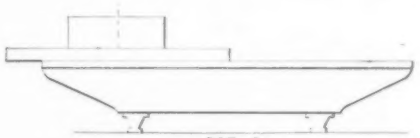


FIG. 34

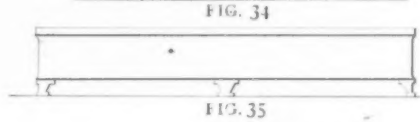


FIG. 35

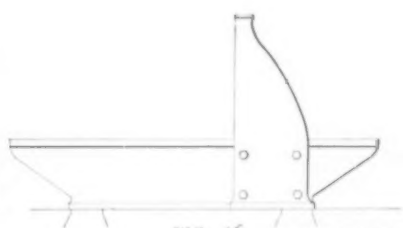


FIG. 36

SUPPORT OF LATHE AND PLANER BEDS.

THE ANVIL PRINCIPLE IN LATHES.

If there is any other place where it is as easy to fool away money as to put on a coreprint and make a core box to take iron out of a lathe headstock, I do not at this time think where it is. If there is any place, except under a forge hammer, where the anvil element needs to exist more than in a lathe headstock, it will be hard to find it.

COMPOUND RESTS.

If there is anything about a lathe which more than another builders keep making wrong without reason it is the American compound rest, which the user has to set parallel with the cross-feed slide to use in common practise. As made it brings the screw handles just where they cause the most bother to the operator, gives him two ways to do one thing where one is enough and robs him of one motion that he would frequently use if he had it. And it all comes from following habit, without reason. The compound rest can be set at any angle, but it never is set in any way except parallel with the cross-slide because the workman wants the tool-post slot parallel with his work. The remedy, or, to put it stronger, the right way is to put the tool-post slot, as illustrated in the AMERICAN MACHINIST some years ago, page 369, Vol. 21, at an angle of 30 degrees from the usual position. The workman still sets his slide so the slot is parallel with the work, which brings the handles away from each other, enabling him to feed up his tool for a facing cut without disturbing the main slide, to get his tool-post inside the chuck jaws and to take the cut in cutting V-threads all on one side, which reduces the time of thread cutting about one-third.

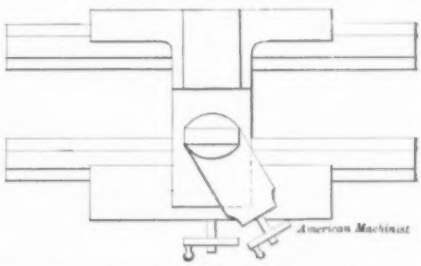


FIG. 37. PROF. SWEET'S FORM OF SLIDE REST.

One builder is prepared to furnish one of these for his 30-inch lathe at the same cost; in fact, any lathe builder can furnish one at the same cost except for the cost of the extra pattern, and yet they will not until someone orders them, and it will be

twenty years before anyone will do that. It was fully twenty years or more after the ring oiler was illustrated and described in *Engineering* before anyone else took it up, and then only after Mr. Edison had set the example.

And now as I close this series of articles the question arises, is any good to come from this tirade about things that seem to me to be wrong? One who cannot reconcile himself to the spelling (tough) tuf, (thought) thot, and (straight) strat need not expect the other old fellows are going to change their patterns, or practise, even should they be convinced that they are wrong, and it is only those who come to think of the best way who are likely to do the best; and those also who think that the "best way is bad enough."

Miss Clara Medlin, of Pilot Oak, Ky., is said to be an expert and fully equipped blacksmith. We are assured by *The Hub* that she "is a very handsome young lady, with a wealth of dark-brown hair and a pair of bewitching brown eyes. She can shoe a horse or weld a tire as quickly as any smith in this section, and as for neatness no other smith will dare to compete with her. She is also an expert carriage painter. This is really her specialty, she having painted over seventy buggies the past season. Notwithstanding all of this, Miss Medlin has not neglected to educate herself in housekeeping and cooking. As an all-round useful girl she cannot be excelled anywhere in 'Old Kaintuck.'"

The power consumption of electric lamps was summarized as follows by Prof. H. T. Davidge in a recent paper before the Junior Institution of Engineers: Incandescent lamps, 2½ to 4½ watts per candle-power; enclosed arc lamps, 2½ to 4 watts; Nernst lamps, 1½ to 2½ watts; open-arc lamps, 0.8 to 1½ watts.

A New Boring Mill.

We illustrate herewith several views and details of a new boring mill which is the first product of the Ridgway Machine Tool Company, of Ridgway, Pa., and is the subject of a good deal of very pardonable pride, not the least source of which is the fact that, starting with nothing but preliminary drawings, the machine was shipped seven months from the date of receipt of the order.

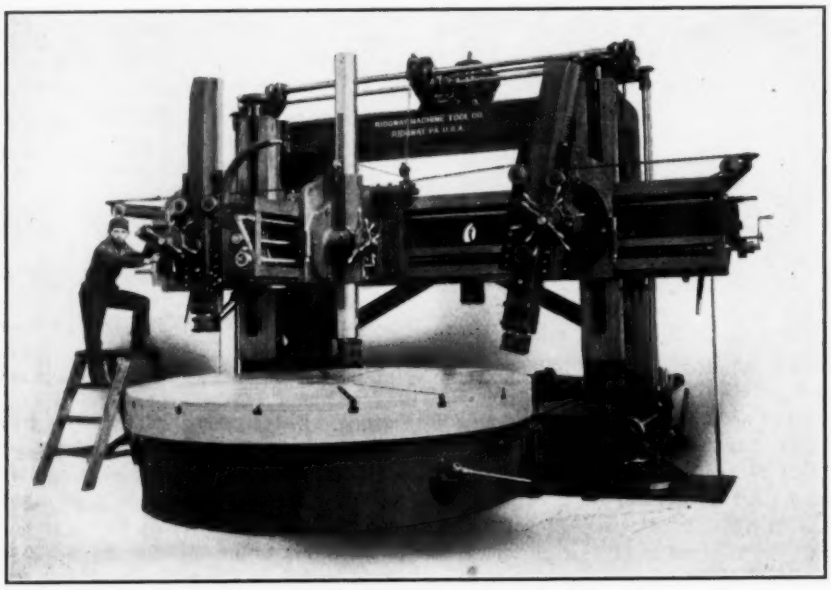


FIG. 1. THE RIDGWAY BORING MILL.

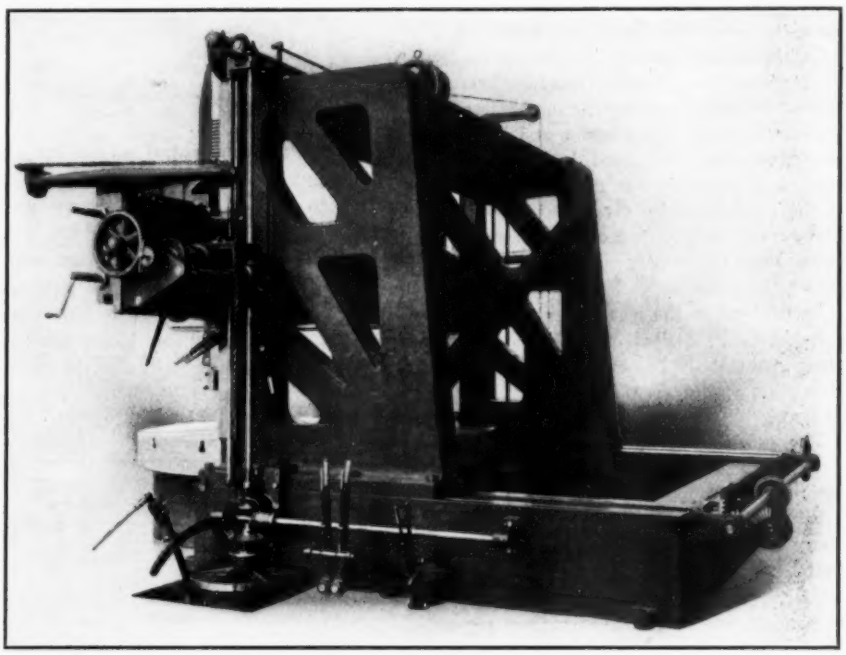


FIG. 2. SIDE VIEW SHOWING BRACING.

The mill is of the extension type, the swing with the housings in the forward position being 10 feet 8 inches, and with the housings run back 16 feet 4 inches. The extreme opening over the table, measured to the bottom of the tool-holder, is 5 feet 2 inches, and to the cross-rail, 5 feet 10 inches. The diameter of the table is 10 feet, and it is carried either by a circular track or by a foot step, the connection for raising the step being shown in Fig. 1 with a wrench attached. The track is arranged to be flooded with oil. The main driving gear is from a high carbon rolled steel ring.

Some of the most striking features of the mill are structural, and these are well shown in the half-tones, their chief object being to give stiffness to the machine. Fig. 1 shows a rear X-brace to the housings, which feature is, however, much better shown in Fig. 2, as is also the correct form of the bracing which is incorporated in the housings. The rear brace will be seen to effectively provide for the tilting strain of the tool when taking a side cut. It does not, however, provide for the twisting strain upon the overhead work as a whole and to meet this the very substantial shelf on which the traversing motor is mounted is provided. The effectiveness of this is shown by the overhead view, Fig. 3, which also shows the exceptionally stiff construction of the extension arm and the location of the main driving motor within the base.

The overhead motor is for traversing the heads on the rail and the bars in the heads, the feed being taken from the main motor. In the present case the feed is of the friction disk type, which was preferred by the purchasers, tho a positive geared feed has been designed for the machine. The traverse gear of the overhead motor applies also to the head and bar of the extension arm, which is of sufficient length to permit facing to the center when the housings are run back to the extreme position, and it is also fitted to carry a boring bar in this position.

Referring to Fig. 2, the right-hand lever near the middle of the base controls the

traverse of the uprights while the two at its left operate clutches for speed change gears and are interlocked, as will be shown later. The lever connected with a projecting arc controls the friction feed change

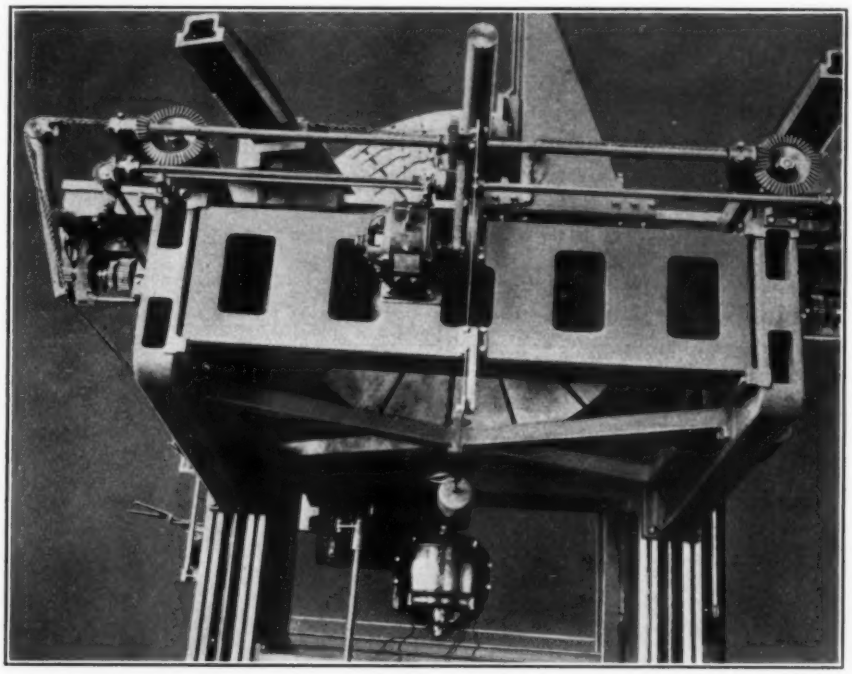


FIG. 3. OVERHEAD VIEW SHOWING STIFFENING BRACKET.

and the inclined lever hanging from the base—better seen in Fig. 1—controls the table spindle foot step. Of the two parallel levers projecting beneath the cross-rail the outer one reverses the feed and the inner one reverses the power traverse of the heads on the rail, while the lever at the right of these controls the elevating gear for the cross-rail. The cross-rail levers are duplicated at the opposite side of the machine. The connections to the traversing motor are by friction clutches which may be thrown in or out with the motor in motion. At the extreme left of the joint between base and upright in Fig. 2 will be seen a pair of faced pieces on which are marks which locate the position of the uprights for the smallest swing, in which position the center of the tool-holder is exactly over the center of the table.

Fig. 4 shows the method of connecting the cross-rail to the housings in order to avoid carrying the strains thru the section of the rail which is in front of the housing and which is necessarily the weakest section. Gibs *a*, of which the length is the entire depth of the rail, secure rail and housing together in a manner which is obviously very stiff. Fig. 5 shows a cross-section of the rail, the vertical support of the head being by the surface *a*, the entire guiding of the head, except that which prevents its tilting forward, being thus near the bottom of the rail and thus conforming to the method of guiding such members which was recently advocated in our columns by Professor Sweet.

Fig. 6 shows the extremely neat method of interlocking the pair of speed change levers at the right of the friction feed

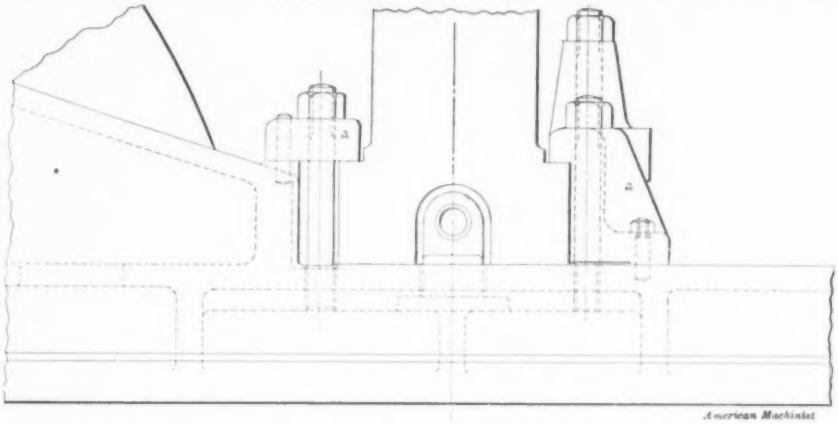


FIG. 4. PLAN OF CROSS-RAIL SHOWING CONNECTION TO HOUSING.

disk, Fig. 2. These levers move parallel with the bed and have each a latch-pin *a* dropping into the casting behind which must be released by depressing the latch levers *b* before the main levers *c* can be moved. Passing in front of the outer ends of the pins is a turned sliding bar *d* having two grooves and unless its groove is in front of a pin the latter cannot be released. In the position shown in the plan either pin may be unlocked, but when unlocked the pin enters the groove in the bar and any movement of the lever will carry the bar with it and thus make it impossible to unlock the other lever. One

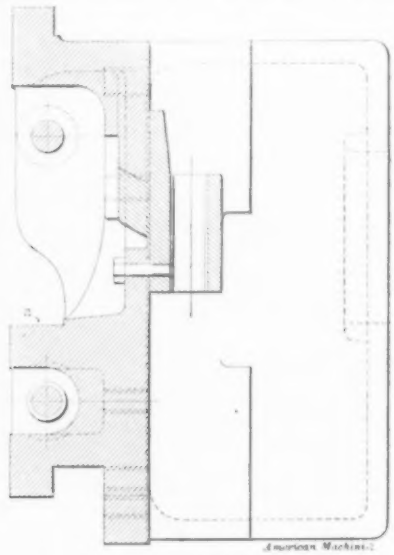


FIG. 5. CROSS-SECTION OF RAIL.

of the levers has two positions and the other three, but it will be seen that with either lever displaced from its neutral position the other cannot be moved. These levers give three speed gear changes which supplement the twenty speeds given by the motor, making sixty in all, the total range being from ⅓ to 18 revolutions of the table per minute. The feed range is from 1-64 to 2¾ inches per revolution. Of the small details it may be remarked that all dowel pins have nuts on their large ends to facilitate their withdrawal.

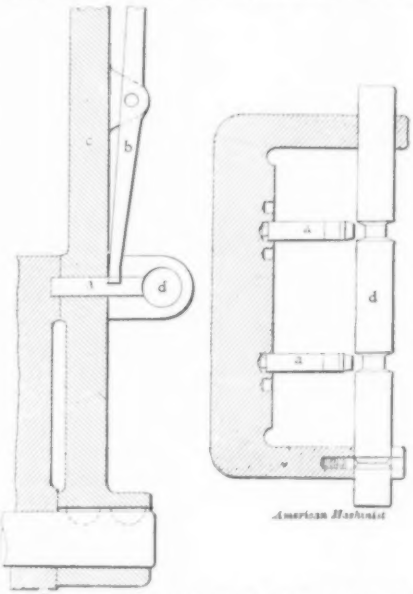


FIG. 6. INTERLOCKING DEVICE FOR THE SPEED GEAR LEVERS.

Boring, Turning and Keyseating Flywheels on a Pit Lathe.

EDITORIAL CORRESPONDENCE.

The accompanying illustrations show the application of a pit lathe to flywheel making, and for them I am indebted to the Nordberg Manufacturing Company, of Milwaukee, Wis.

Fig. 1 shows the rear end of the headstock as arranged for the first operation—boring the hub of the flywheel. The motor in the foreground drives a worm shaft which in turn, thru a worm wheel enclosed in a casing above the worm, drives the long sleeve which projects from the casing, and within and driven by which is the boring bar. The farther end of the bar is supported by a bearing mounted on the footstock of the lathe. The left-hand end of the sleeve carries a gear which drives the upper shaft carrying other gears which mesh with still others which are concentric with the one on the sleeve but are mounted on a shaft which drives the feed screw within the sleeve. This screw engages with a nut in the end of the bar and turns with it, the rate of feed being determined by the difference between the speeds of the bar and screw—the action of the gearing being differential. These gears are covered in the machine, but the cover has been removed in making the exposure.

The first operation is, of course, to chuck the wheel against the flywheel, truing up being done by turning the face-plate. The wheel being chucked, the face-plate is then locked and the hole is bored as described.

For turning the rim a mandrel is inserted and the wheel is released from the face-plate—this operation being facilitated by the fact that the wheels are usually in halves. As this lathe is used for turning hoisting-engine drums of great weight, the support of the work upon centers is abandoned, the headstock end of the mandrel being tapered and fitted to a taper seat in the end of the live spindle and the footstock end being carried in a bearing on the footstock. The drive when turning is from the motor shown in Fig. 1, but the belt shown is removed and another is substituted which connects the motor with a pulley behind the work table in the lower right-hand corner of the illustration, and hence not shown. The belt from this pulley is, however, shown lying on the floor and indicates the position of the pulley, which is upon a shaft extending across the headstock and has upon its further end a worm which engages with a worm-wheel within the casing shown in the rear and from which the face-plate is driven by a pinion meshing with the gear teeth upon the face-plate.

The keyseating operation is shown in Figs 2 and 3, the former showing the nature of the method and the latter showing the method of driving. One-half of the wheel is again strapped to the face-plate, while the other is removed and the keyseating bar is inserted, the front end entering a bush in the live spindle by which it is guided and the rear end being carried by a bearing supported by the footstock as shown. This bearing carries a horn upon which are mounted the driving gears—a rack on the bar serving to connect the gearing with the bar. The driving pinion shaft carries a gear which meshes with a pinion on the shaft of which is a grooved friction disk fitted to engage with either of two smaller disks shown at its left. These smaller disks are connected by gears and are arranged upon a jointed connection to the frame which has a handle projecting toward the flywheel by which either of the friction disks may be thrown into mesh—the action being precisely that of the tumble gear for reversing the feed of a lathe carriage. The bar is thus caused to reciprocate by manipulating the lever—the spring shown connected to the lever being for its support. The method of driving is by the shaft shown in Fig. 2, which is driven by the motor supported upon the turning tool-rest, as shown in Fig. 3. The keyseating tool-holder has a small swiveled tool-holder or clapper box which, however, carries two tools, one of which acts in each direction of movement of the bar. One of these tools plows out the center of the cut and the other completes its width.

F. A. H.

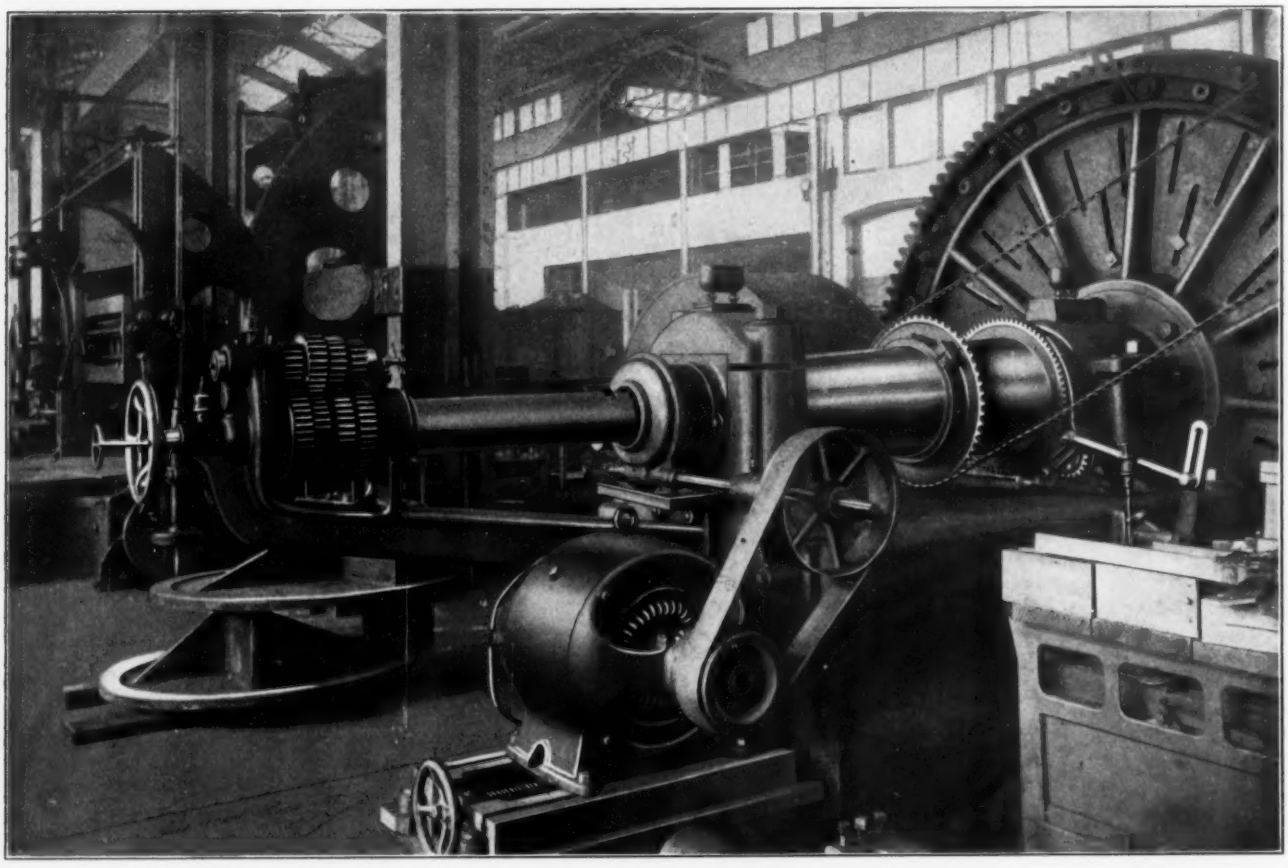


FIG. 1. BORING BAR DRIVING MECHANISM.

Iron scale is recommended as an addition to Portland cement, to strengthen the wearing surface of cement sidewalks.

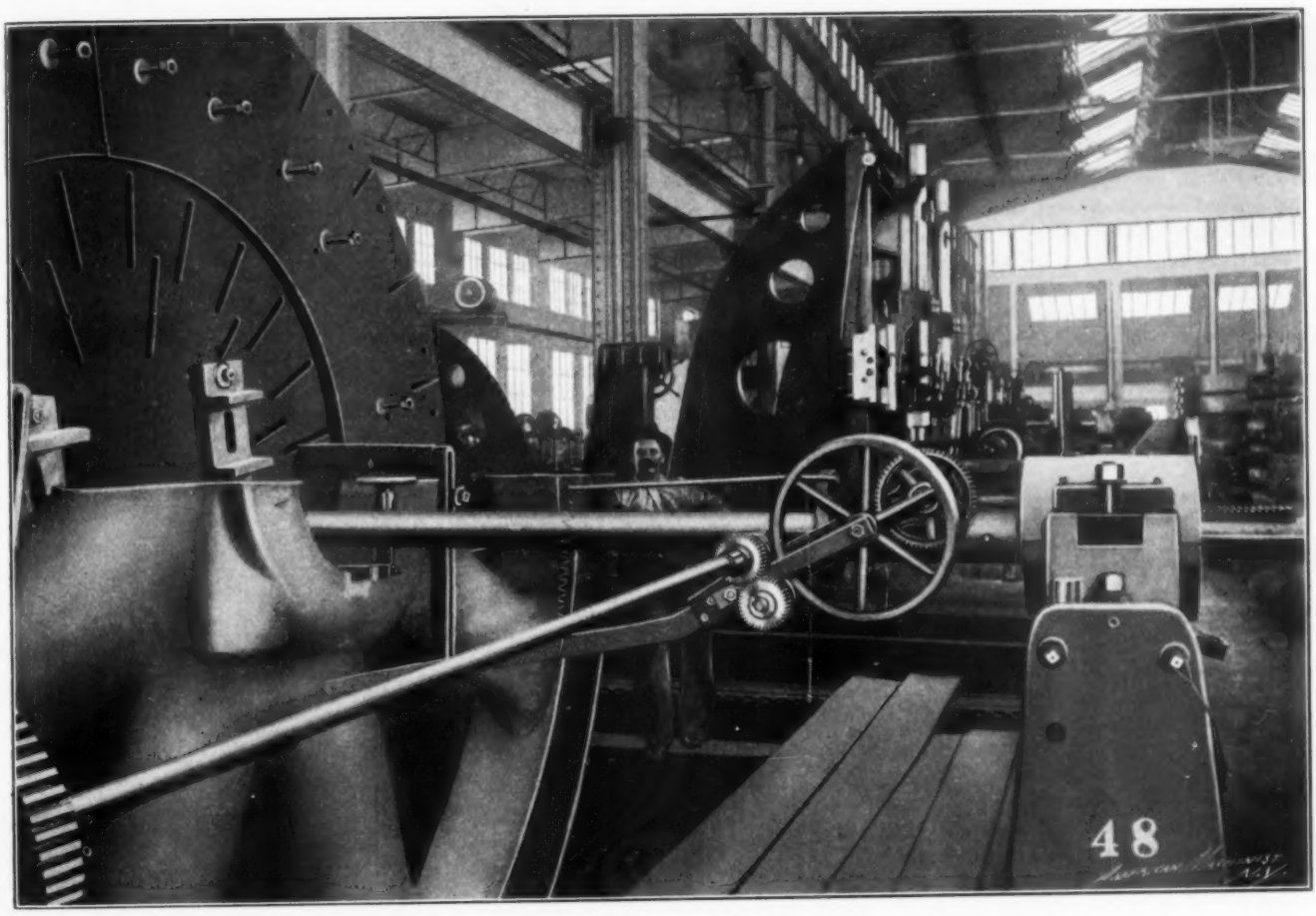


FIG. 2. THE KEYSEATING BAR AT WORK.

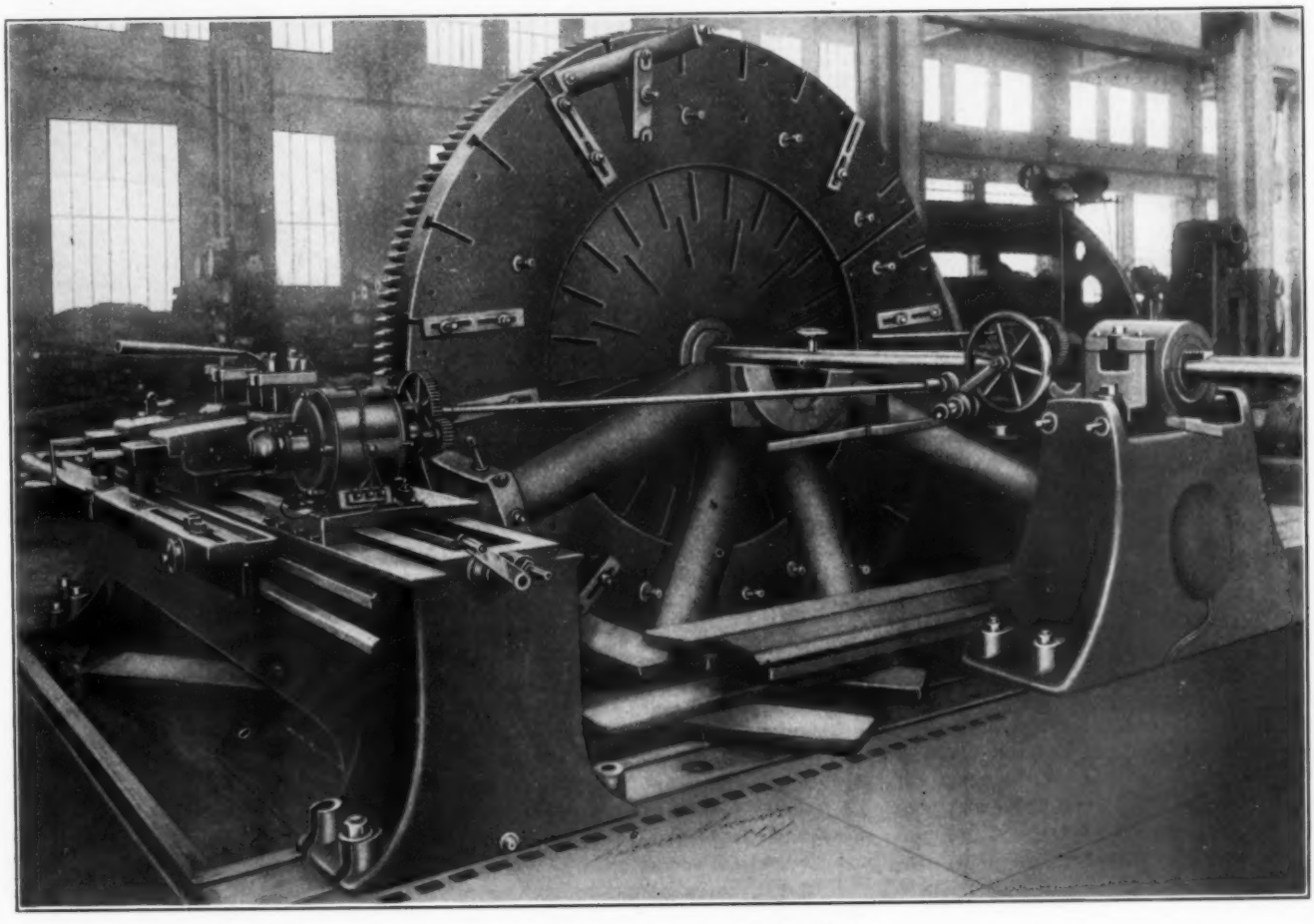


FIG. 3. METHOD OF DRIVING KEYSEATING BAR.

Molding Crooked to Make Straight Castings.

BY THOMAS MACK.

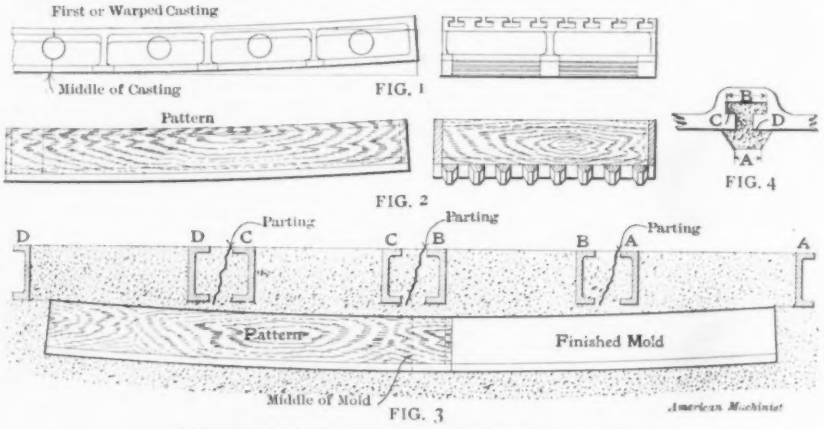
The warping of castings on account of differences in thickness of metal is a trouble often encountered by the patternmaker, and one not always thought of by him until his attention is called to a badly warped casting and he is asked to explain its cause. The chances are that too often he will say: "Consult the foundry foreman; he is the one to blame. They probably lifted the cope off too soon," or some similar suggestion.

A good illustration of this kind of experience came under my observation not long since, when a casting like that shown in Fig. 1 was to be made. In this illustration the casting is shown by the full lines, distorted as it came from the mold, and the dotted and dashed lines show the straight outline of the casting required. The distortion has been exaggerated to make it plainer in the illustration. The casting is one of the four sections of a floor plate, as used in shops doing heavy work. When placed together the four pieces form a surface of 1,024 square feet, each section being 32 feet long, 8 feet wide, 16 inches deep and weighing 22 tons. In the webs and the lower part of the casting the metal was 1⅜ inches thick, while in the upper part, which contained the T-slots for the bolt heads, it was about 4¾ inches thick. The first casting was warped lengthwise, as shown in Fig. 1, 1⅝ inches out of straight. An attempt was made to straighten it by heating, but it was finally broken up for scrap.

The cause of the casting's warping to such an extent was then discussed, and the conclusion was reached that the thinner upper part of the casting as it lay in the mold cooled first, and when the heavy portion containing the bolt slots cooled it shrunk and sprung the upper portion out of truth, as shown.

To avoid this warping it was decided to rebuild the pattern. It was made, as before, in length about 12 inches longer than one-half of the required casting, but the pattern was purposely warped in the reverse direction from that of the warped casting. This pattern is shown in Fig. 2, the warp here also being exaggerated for the sake of clearness. When the castings from this pattern were taken from the mold they were all that could be desired, as none of the four showed more than ¼ inch of curvature.

In making the mold a hole was dug for the entire length of the casting and the half pattern was placed in one end of this hole with the end blocked up high enough to bring the other end, or the middle of the complete mold level. It was then rammed and tucked up and the two sectional flasks *A* and *B* were placed in position and rammed up, with the parting between them, as shown, wing bars being bolted to the outsides of the flasks to support this overhanging sand. The parting was made at an angle, as shown, so as to allow the flasks to be lifted off and replaced separately without crushing. The ramming of this first portion of the pattern being complete, the flasks were lifted off and marks were made on the mold opposite the center of the pattern; the pattern was drawn, turned end for end, and placed in the opposite end of the hole care being taken to see that the center line of the pattern came opposite the marks on the sides of the mold. As the pattern was made 12 inches longer than one-half of the casting, this insured a 24-inch lap or bearing upon the portion of mold already completed, and thus assisted in lining up and setting. After the pattern was in place and tucked and rammed up, the flask *B* was returned to its place, and flasks *C* and *D* were placed successively in position and rammed up, with partings made as before. The flasks were then lifted off, the pattern was drawn, the mold finished, the cores set, gate cut, and all made ready for pouring. In Fig. 3 the pattern is shown in its second position in the mold, the dotted line being about the center of the casting.



CASTING CROOKED TO SECURE STRAIGHT CASTINGS.

To avoid the use of a large number of chaplets on the tops of the cores for the T-slots, a very simple device was employed. This is illustrated in greater detail in Fig. 4, which is a cross-section of the T-slot with core in place. It will be noticed that the core print is wider than the T-slot, and hence the molten metal, which exerts a lifting force under the overhanging portion *C*, will be more than balanced by the metal bearing down on the portion *D*. When cores are made and carefully set according to this system no chaplets will be needed on top of them, and of course after the entire core is submerged it will be held down by the metal above it.

The interesting point in this matter is the fact that the pattern had to be sprung a certain amount to overcome the distortion which would naturally occur in cooling. The exact amount that any pattern will have to be distorted to accomplish this result can only be ascertained by experiment, tho experience will often enable the patternmaker to make a very close approximation at the first trial. The depth of cope used may in some cases have an influence on the result.

Honors to a Mechanic.

Some time since, Mr. W. K. Jenne, who for a number of years had been manager of the Remington typewriter factory at Ilion, N. Y., was retired, tho he still retains a less active connection with the company. Mr. Jenne had been in general charge of the manufacture of the Remington typewriter since the beginning of the business, and had been very successful with it. On the occasion of his retirement there was a gathering in New York of the prominent officers and others connected with the business; there was a banquet and speechmaking, and a presentation, all going to show the very high appreciation in which Mr. Jenne has been, and is, held by the company. Referring to this, one of our Southern contemporaries, *The Atlanta Journal*, publishes the following editorial comment which, it seems to us, fits the case and is particularly significant in view of the fact that it comes from a Southern journal and a section of the country wherein mechanics have not always in the past been appreciated very fully or esteemed very highly. *The Atlanta Journal's* article is as follows:

The retirement of an old mechanic was marked the other day by a complimentary dinner at the Waldorf-Astoria and the tendering of a loving cup.

Had this man been a statesman, a rich banker, or a great prince of commerce, there would have been nothing to excite remark in the honors paid him.

But the world is growing better.

Men are learning to distinguish sometimes between the highly polished gilding and the raw true gold.

To this old mechanic is due perhaps more than to any other man the marvelous development of the typewriter from an untried experiment to the necessity it has now become in the world's work.

Thru his genius and labors the activity and celerity of all business has been im-

measurably quickened. He is as true a benefactor of the race as is known to this generation.

To the man who furnishes the capital, builds the factory and directs the sale of the product, richly lining his pocket, the world has long been accustomed to pay reverence.

It is a good thing, for a change, to take off our hats to the man who furnishes the ideas—whose brains and brawn, passing thru the crucible, turn to gold.

We have had a surfeit of "captains of industry," commercial magnates and kings of finance, who barter and exchange the product of other men's intellect and toil. It is a charming relief to exalt one of the few men who have really enriched the world by giving to it a new idea.

Customs and public opinion move in cycles. In the complimentary dinner given to the old mechanic at New York's swell hostelry there is suggestion of the same spirit that marked the great feast of honor of the completion of Solomon's temple, when the artists in mosaics, the skilled cutters of stone, the fine workers in wood and precious metals were waved aside by the great king, and the humble, hard-handed blacksmith was given the high seat of honor, because he had made the tools which all these men had wrought their wonders with.

Automobile Crank-Case Boring Machine.

The accompanying photograph, Fig. 1, shows a Baker heavy vertical boring machine arranged with special revolving jig for machining opposed cylinder crank cases. The machine bores and faces one end of the case, then the chuck is rotated one-half turn and the other end is finished. The chuck is securely locked in position by means of taper pins which can be quickly withdrawn when it is desired to turn the chuck.

The driving gear has a ratio of 43 to 1 with twelve speed changes. Geared feed with twenty changes is also provided, giving feeds from five-thousandths of an inch to one-eighth of an inch per turn of the spindle. The spindle is heavy and rigid, allowing the use of sweep cutters for facing.

By referring to Fig. 2, it will be noticed that the two bores of the crank case are not on the same center line, but three inches apart. This is provided for in the chuck by bolting it to the column 1½ inches from the center line of the spindle. The output of the machine on the crank case shown at Fig. 2 is thirty in ten hours, taking four cuts on each end: rough boring, finish boring, rough facing, and finish facing. The cutter head is so constructed that all these operations are performed with the same head. Any number of these machines can be connected together as a multiple spindle machine, one man operating several spindles. The manufacturers are Baker Brothers, Toledo, Ohio.

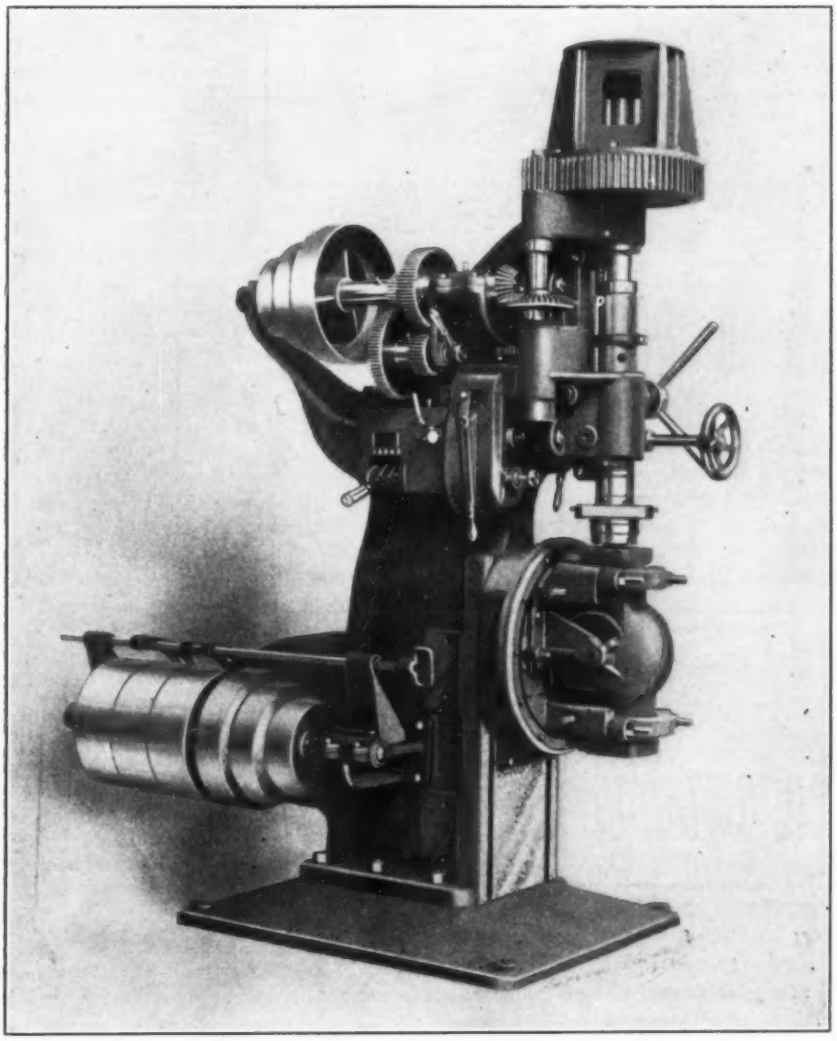


FIG. 1. AUTOMOBILE CRANK-CASE BORING MACHINE.

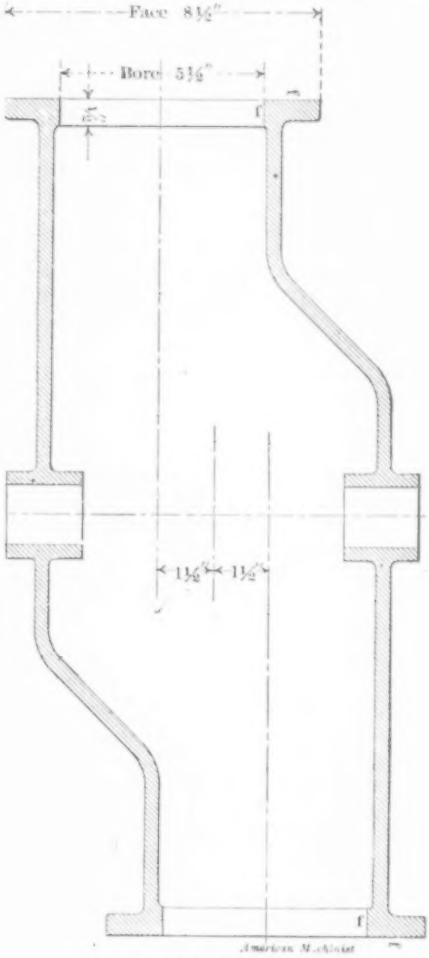


FIG. 2. THE CRANK CASE.

The Rome Merchant Iron Mill, Rome, N. Y., was destroyed by fire February 7. The fire was caused by a combination of oily waste, greasy floor and a workman's torch.

That New Haven surgeon who opened a man's abdomen, removed his apendix and left a roll of gauze in the abdominal cavity when he closed it, might be some relation to Chordal's good mechanic who avoided small mistakes and oversights—nearly always had things just right, but when he did make a mistake, made one worth while—left a monkey-wrench in a cylinder, or something of that kind.

Letters to the Editor.

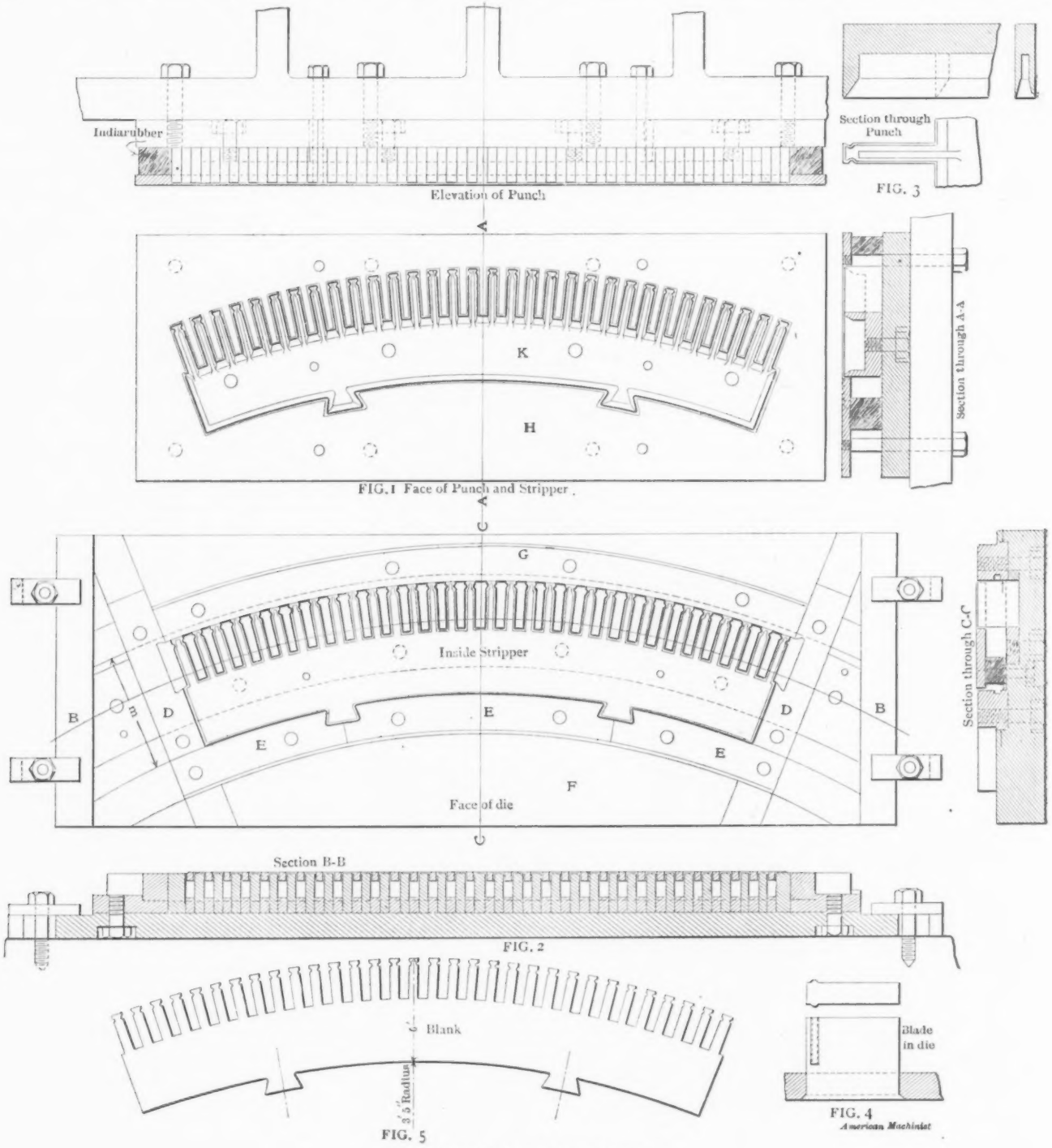
Compound Armature Segment Die.

I send you a drawing of a compound segment die for armature punchings. Before describing this die I would call attention to a very good description of the method of making the templets for this class of dies, which was given at page 1070, Vol. 27, by A. Toolmaker. Again at page 1266, Vol. 27, is shown a widened Gray planer with an attachment for radial planing and grinding. At the works where the die which I am about to describe was made, an open-side Detrick & Harvey planer with a similar attachment was used, it being an excellent planer for this class of work. The grinding attachment was used for finishing the hardened pieces. That is to say, the pieces (or work) were first radial-planed, then hardened, then ground to a finish.

The die here illustrated is described as follows: The gray-iron die-plate *F*, Fig. 2, is taken first and top and bottom are planed, also the slots for side pieces *D*. Then it is placed on the radial planer and the center is dug out for the mild-steel plate used for holding the blades, as shown at *M*, Fig. 2, also in section thru *CC*.

The mild-steel plate *M* is fitted into the gray-iron die-plate *F* and screwed and doweled into position. Then the plate *F* is again placed on the radial planer, and the slots are planed for the curved tool-steel die pieces *E* and *G*.

These tool-steel die pieces are first heated and bent to the approximate radius, then the tops and bottoms are planed, after which the circular edges are planed. The dovetails in *E* are slotted and the pieces split thru the center of dovetails, an allowance being made for grinding to a fit after hardening. The screw holes are next drilled and tapped in *E* and *G*.



COMPOUND ARMATURE SEGMENT DIE.

and they are then hardened and drawn (or tempered). The top and bottom are then ground on a surface grinder. The pieces are now ready for the radial grinding operation, which is done by first placing them top side down and grinding at points indicated by arrows in section thru *C C*, Fig. 2. The dovetails in *E* are fitted to a templet, after which both *E* and *G* are placed in die plate *F* and fastened in position. The plate is then put on the radial planer and the die is ground true to fit the templet. The side pieces *D* are finished on the surface grinder. The method of holding the tool-steel blades in the mild-steel plate *M* is shown in Fig. 4. The half blades at each end are dovetailed into side pieces *D*. Rubber is used under the inside stripper for bringing up the punching.

The punch *K*, Fig. 1, is a tool-steel forging, in one piece. It is planed top and bottom and on the outer arc also. The templet is then placed on the face of the punch, and the slots, the inside arc and sides are accurately scribed off. Then the punch is slotted to the lines, very little filing being req ired if the job is properly done. The inside is then dug out, as shown in Fig. 1, and more clearly in Fig. 3, leaving a wall about ½ inch thick around the edge of the punch; this wall is milled at an angle almost to an edge. The solid portion between the slots also is milled at an angle; about 1-32 inch flat surface being given all around the cutting edge. This punch is not hardened. Therefore, after being in use and showing signs of wear, it is taken out and the cutting edges are hammered (or flattened). Then it is again placed in the press in proper relation to the die and brought down into the die, the edges being thus accurately sheared to size. An outside stripper is provided for this punch, rubber being used under the stripper for clearing the punch of scrap material.

Fig. 5 shows the blank as punched complete in this die at one operation. Eight of these segments are in this case required to complete the circle.

One point more should be noticed. It will be seen that the heads of the cap screws for holding the die pieces are flush with the bottom of the die plate shown in the section thru *C C*, Fig. 2; also the cap screws holding the punch to the plate, shown in elevation of punch, Fig. 1, are flush with the bottom of the plate. This is done to avoid all possible chance of pieces working loose while in the press. Dies of this type are made in sizes from 20 inches outside radius upward.

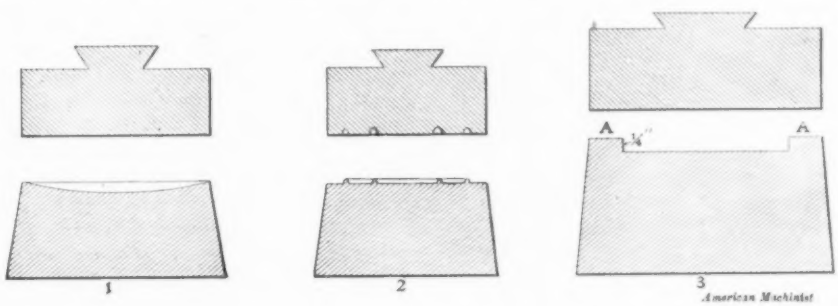
WM. F. HOFFMANN.

Manchester, Eng.

Flattening Punched Work.

We have had a lot of punched work lately that had to be left very flat and free from "buckle" and the trouble we had to get it out to suit our customer made me think that some of the rest of the press fellows would like to hear about it. I do not know that there is any more trouble in the punch and die business than in any other, but it is often hard work to make a customer understand (especially if he is not a mechanic) why it takes so long to find out how to do a thing, and also why he should be charged for that time when we do not "deliver the goods" in a visible form.

But, to come back to flattening the blanks. First we had a lot of round disks 8 inches in diameter and 5-16 inch thick that had to be flat and not reduced in thickness. The stock was .040 carbon and the blanks had a 2-inch hole in them. Striking them two or three blows between a pair of flat dies had no effect upon them, so we then made a pair of dies like No. 1 in the sketch, the dies being concaved 1-16 inch and the upper die convexed or "crowned" the same amount. The blanks were struck a good solid blow so as to dish them well, and they were then turned over and struck just hard enough to bring them straight. It took a little practise to get the hang of the job, but after that we had no trouble, and, what was better yet, no kick from our customer.



The next job in this line was a lot of 7-inch disks .035 thick, made of spring copper. Altho we knew they must be flat, we did not expect any trouble, but when we reached the flattening part we found trouble waiting for us in bunches. The dies we used on the 5-16 inch disks would dish the blanks all right, but no kind of a blow would leave them flat. The trouble seemed to be in the spring of the metal, as they all would have a "buckle" in them. Then we made a pair of dies like No. 2, put two rings in them, projections on one face and corresponding depressions on the other, and took care to make a good job. This left the disks pretty good, and by working at them until we got the rings just large enough to take the "slack" out of the blank, they came good and true. The rings also stiffened the blanks and kept them in the shape in which the dies left them.

The next job in this line was a lot of square punchings that had to be brought to a given thickness, and we could do them hot if it would bring the work out any better. We had an old pair of flattening dies; we annealed one of them, and planed it out like No. 3, leaving the sides *A A* ¼ inch high, and then grinding both the sides and the face of the die after hardening. The flattening was done in a light forging drop; the work was heated up to a dark red (or as hot as we could and not raise a scale), and struck one blow. The pieces came out of the dies flat and of an even thickness, but the cost of the work was more than we first estimated.

When the work is very thin, I know of no better way than to grind the dies good and true, lap them together with a little emery and oil, and then set them in the press so that when you put pieces of tissue paper under the corners it will bite all four alike. With a light power drop the cost of flattening thin press work should not be over six or eight cents per thousand. We have a record on the books of a press hand "flat dropping" (as we call it) 44,000 pieces in a day of ten hours, using an ordinary rope drop press.

The trick of straightening a blank with a "buckle" is to first put in a crook that will take out all the "buckle," and then take out the crook. J. L. LUCAS.

Taps for Steel Nuts.

At page 227 Allan Winter describes a tap for steel nuts. While I do not know under what conditions this tap is worked, I do know that I have tried the same expedient (excessive rake), and with disastrous results. Not only did the taps break easily, but the chips would jam very tight in the nuts, causing trouble. We tap thousands of nuts, mostly gray and malleable iron, and the taps are used under the most trying conditions, a boy holding the nuts in a special holder and the taps running in a speed lathe, ½ inch at 250 revolutions; ⅜ inch, 330; 5-16 and ¼ inch, 450; 2,500 ½-inch malleable iron nuts being the average number finished per day of 10¼ hours, smaller sizes in proportionately larger numbers.

I make all taps (nut) with as little rake as possible and with two-thirds of the tap tapered, putting a straight tit at the bottom of the taper about .005 inch smaller than the hole in the nut to guide the tap, thereby causing the nut to be tapped straight and preventing any undue strain on a tap. I use ordinary tap steel, and a tap running at the speeds named will last about four days, or tap 10,000 malleable-iron nuts; on gray iron, 7,000 to 8,000, using good screw-cutting oil. All of our

taps must be relieved back of the cutting edge, otherwise they pull too hard and cut a rough thread. As for width of land, I think Mr. Winter's list is about right. H. H. B.

The Hand Versus the Automatic Turret Lathe.

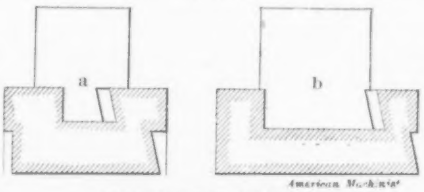
At page 108 Paul Wesley has an article on the above subject. I do not claim to be an expert on either type, but have had some experience on some of them; in fact, have one hand machine now under my care, and on a line of work for which there are no tools on the market, so I have to devise ways and means myself. When I took charge tools were in use which were designed to do what I do not think is practicable—that is, to drill and ream a hole (a cored hole) to finish size at the rate of 250 to 300 per day. Of course it can be done, but it will take a machine that is kept right up to the notch, and we all know that it would take a different kind of man from the usual operative to do the work. Also he would have to put quality strictly in the first place, and he might get out 50 or he might get out 200 pieces as a day's work. If that were the only thing which the machine was expected to produce, it would be enough to keep up that end of the work; but when the man has to run the errands, oil the shafting, sweep the floor and make several other pieces on the machine he has to "go along some" to keep stock up on all the different jobs. Now, I do not see how the method of machining the pieces in Mr. Wesley s sketch on the hand machine would be improved by the method described for the automatics. These pieces I think I recognize as parts of the spindles for ring spinning frames; their speed is something terrific, and if they are out of balance they will cause all sorts of bother, as they are about 6 inches long and depend upon one bearing at the bottom to steady them. If I were going to rig up an automatic to make those pieces, I should do just what Mr. Wesley has done; that is, leave the finishing to be done by another machine. I notice he reams them to finish size on (I should say) a speed lathe with lever feed tailstock spindle. I do not think his method of holding them to finish the outside could be improved much, but I suggest that a slight improvement in his fixture would be some provision for removing the finished piece. I do not see any such provision in his sketch. I do not wish it to be thought that I do not believe in the automatic turret machines, but I think there are plenty of places where, taking everything into consideration, the hand machines will answer just as well or better; in fact, I think in some cases hand work is more practical than any machine work. I know of one case in particular where a large concern making some of the most modern and up-to-date small tools does a great deal of hand work in finishing its micrometer calipers. It could be done by machinery, but would require a rather complicated machine to do it as well as it is done by hand with a file and emery cloth. Of course this work is not on the measuring part of the instrument but around the edges. Now, if we could have some way of making a machine stay in absolute alinement we could do accurate work on any old machine, but there is where the rub comes. When you have only one machine, and so much work for it that you have to keep it going about all the time, you cannot overhaul it until it is absolutely necessary to do so.

D. W. Rogers.

Hammer Dies.

At page 1711, Vol. 27, Thos. Beasley has an article on forging which makes me think of a job I once held. It was making file forging dies. There were fifteen hammers, mostly Bradley cushion, but a few of them were plain trip hammers. They had a lot of trouble with the dies from the shanks breaking off, as at *a*. I suggested for an experiment to make them as at *b*, which gave good satisfaction and service, besides saving a lot of time and work in making the dies.

As our work was steel, we used on the



HAMMER DIE SHANKS.

larger sizes of work a small blast to blow the scale off the dies, instead of a stream of water. On the small sizes we did not use anything, as generally the scale did not give much trouble. These dies were made of blocks that we got about the right sizes from the makers. There were about twenty different sizes. The dies generally had to be dressed over about once a month, and making new ones and keeping the old ones in repair was about as much as one man wanted to do. I did not have to harden them myself.

D. W. Rogers.

Adamite as an Abrasive.

C. H. Norton at page 143 says "there are four cutting materials now used—emery, alundum, carborundum and corundum." This statement, coming from a gentleman of Mr. Norton's wide experience, would lead one to suppose that this list included *all* of the abrasives now in common use. Is it possible that he has never heard of that other product of the electric furnace known as "adamite," and introduced before his company began the manufacture of alundum? In efficiency as an abrasive this material certainly ranks with the others named by Mr. Norton, and I am at a loss to understand why he neglects to mention it.

It may be of interest to point out that both adamite and alundum are artificial corundums, produced by crystalizing aluminous compounds by means of the electric arc. Carborundum is produced in a similar way, but the materials used are composed mainly of carbon and silicon.

Natural corundum, such as is now obtained from the Canadian corundum mines, is practically pure crystalline aluminum oxide (Al_2O_3) and emery is corundum containing an admixture of iron as an impurity. H. A. Richmond.

Lead in Bronzes.

I read with great interest the abstract of the paper given by Strickland L. Kneass at page 1667, Vol. 27. I have not the article here, but I was exceedingly surprised on reading G. H. Clamer's remarks thereon at page 80 of the current colume. Why is it necessary to try to bluff a government or any other inspector? The deduction from Mr. Clamer's narrative is that it is at times advisable, but I consider it a great mistake to allow such unprincipled advice to appear in print, especially in a journal so widely read and carrying such weight as the American Machinist, where it will probably be read by as many inspectors as foundrymen.

The advice certainly will not improve the latter's existence, which even under the very best conditions, and with the purest metals on the market to use, is not by any means all O. K. As far as my experience goes, the best course is to *toe the line*, and if our employers make contracts without considering the nature and possibilities of the alloys concerned, surely they will not expect the foundryman to act dishonestly and risk exposure which would greatly damage their trade and reputation.

Every practical man knows that in certain alloys lead is of service, making the castings sharper, with a denser surface, and more easily machined, to say nothing of cost; but I have yet to learn that for alloys containing a large percentage of phosphorus, and which have to resist great pressures and a tensile test of not less than 35,840 pounds per square inch *any* addition of lead is of the slightest service. Did Mr. Clamer ever see one of those cannon he refers to after it had been used? When they were made—probably forty years ago—the shot used were not like the present-day projectiles, and in addition to that the powder was very coarse and inferior, and I should think the weapons he refers to would be found utterly useless after very little service, for it is now generally admitted that alloys containing lead are not the best for resisting great friction when accompanied by heat.

After lightly touching a great source of trouble and one which all foundrymen would like to eliminate, which he calls "eutectic," Mr. Clamer gives us an alloy of "80 per cent. copper, 10 per cent. tin, and 10 per cent. lead," which on being cast into ingots produce globules on the surface the analysis of which is approximately "74

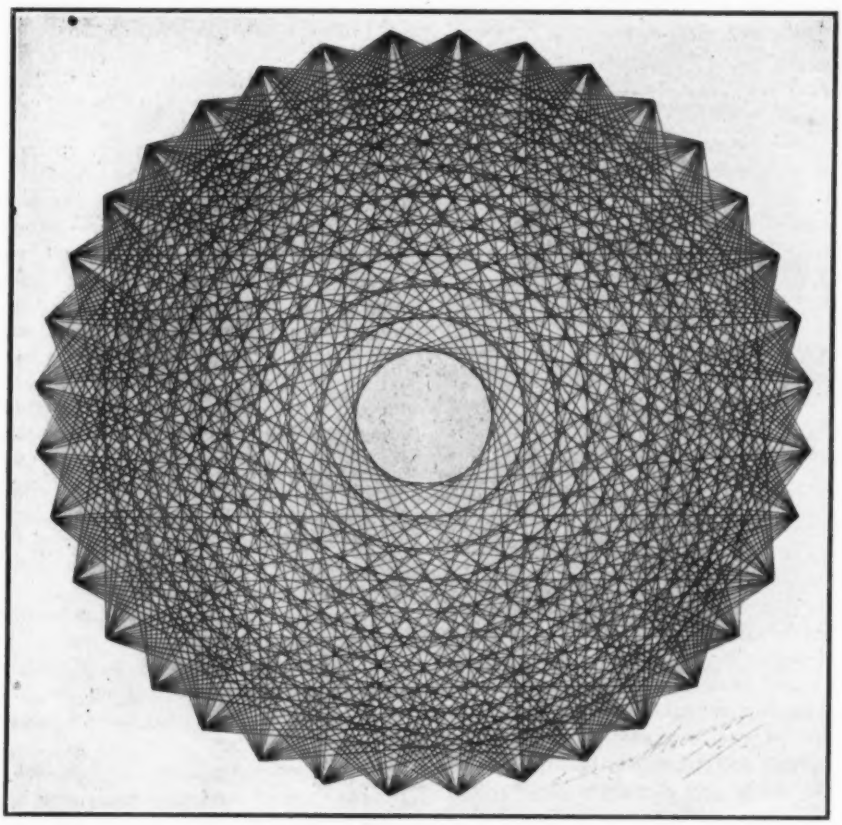
per cent. copper, 22 per cent. tin, 2 per cent. lead and 2 per cent. phosphorus." He says "this, quite likely, is a complicated quadruple eutectic." I also think it might be all that, and would esteem it a favor if he could tell us how the phosphorus got there in any proportion if his original metals were of reliable brands.

ALFRED E. DOWDING.
Foundry Foreman, Torpedo Works,
Weymouth, Eng.

[It is proper to remind our correspondent that Mr. Clamer's remarks, above referred to, cannot be properly characterized as advice, either good or bad, as they comprised simply a narrative of an actual occurrence. It is to be remembered also that the remarks were reprinted verbatim by us from the proceedings of a most respectable organization—the Franklin Institute, of Philadelphia.—Ed.]

A New Way of "Laying Off" Templets.

Having had some experience in making drawings for machines, tools and templets; in making the templets and tools, as well as working on the machines; in photographic work, both technical and as a pastime, I find some things in the remarks regarding "laying out templets," by Dixie and A. Mateur, pape 1743, Vol. 27, and page 117, Vol. 28, that I venture to refer to.



TEST FOR A PHOTOGRAPHIC LENS.

Up to the capacity of my camera, I do not think it would be difficult to get negatives, or prints, that would closely approximate the size I was after and not have distortion enough to cause trouble, but I would draw the line some way from .0001 inch, the amount depending on the size of the final reduction. The smaller the picture the less influence the working of the plate and paper would have. I think lenses are made that would show a more perfect image on the ground glass than most people could work to—if they were to work to lines only for sizes—and as accurate to size as the operator's vision aided by a magnifying focusing glass could determine. For such work I would have very fine lines drawn on the ground glass the required distance apart, and, having the camera mounted on a slide or track, it could easily be moved to obtain the required size, within the limits named, and still keep the focus sharp.

The photograph shown was made from a drawing as a test for a new lens. I do not think there is much distortion in it. The lines do not seem to have any great amount of curve in them, tho the lens is not called rectilinear in the trade. I have made a photograph of a drawing of a machine where the original was to a scale of 4 inches to the foot, on a sheet 22x28, with great care taken by a good draftsman to get every part right, even to using a jeweler's eyeglass to draw in the teeth of the gears and threads of the screws, for the drawing was to be used for show purposes. This was, as a test, photographed on a 4x5 plate, prints from which show clearly and distinctly every line, the threads on representations of ⅝ bolts showing very distinctly, while with fine pointed spacing dividers it was not possible to find distortion in the print. Taking into consideration the working of the negative with its swelling and shrinking and also that of the paper on which the print was made, it does seem as if photography might be able to "lay out the work," but there would have to be some measuring done to get the completed work to .0001 inch.

METOL. HY.

Laps and Lapping.

The article at page 1476, Vol. 27, "How to Charge a Lap—A Proved Surface Lap and Straight-edge," is very interesting as well as instructive, and I have often wondered why there isn't more said about laps and lapping. In the shop where I am employed we use the rotary and surface lap for all finished work requiring true and straight surfaces, and I will endeavor to tell of my experience and observation in that line.

To me it seems strange that a great many mechanics have an idea that if a rotary or surface lap has a perfectly true flat surface most anyone can produce absolutely true results. I find that such is not the case and that there are several facts to be kept in mind. It requires considerable skill, especially when lapping thin pieces, small straight-edges or long narrow strips, and it is possible and requires no skill at all to lap a piece convex or concave on a dead true lap by using a little more pressure in one place than another; and if the surface of the lap is not kept sharp it will soon heat and peen the work out of true. Furthermore, the outer surface of the rotary lap travels faster than the center and of course laps faster, so it is obvious that the work should not be held in one position. The heating and peening of hardened pieces is not so liable to occur on surface laps as on rotary laps. I find also that the less the lap is used near the center the easier it will be to keep its surface straight. I suppose that is because of the speed being less near the center, which tends to roll and loosen the abrasive and therefore wears the surface more than where it keeps cutting.

With a great deal of practise, skill and good judgment both the rotary and surface laps can be kept in first-class condition; we do a lot of fine work on our laps and they haven't had to be trued for a long time.

Our rotary lap is made of an ordinary gray-iron disk mounted on a vertical shaft; it was faced and then provided with anchor holes or grooves. A coating of lead was then cast over the surface, and when cooled it was hammered to make it compact, then it was faced up true, but not perfectly straight. It is left a little higher at the center, as it wears faster here on account of the speed being less, and by a little higher I mean two or

three thousandths of an inch. It is provided with a pan all around, the edges of which project above the surface of the lap; a drip can for water is suspended above the center of the lap, and when we wish to lap very thin pieces without heating we let the water drip freely.

Another handy device on this lap is a bar which is provided with ways and a sliding head which travels by hand from the outer edge to the center of the lap; it is fastened to projecting lugs at opposite sides of the lap frame and is also provided with means for adjusting the ways and the bar so as to stand perfectly square with the surface of the lap; the bar can easily be removed when not in use. The sliding head has a square corner and an angle groove and is used for lapping the ends of round or square pieces.

I have not tried lap charging with emery in cheese cloth and kerosene and gasoline, as described in the article referred to, but have no doubt that it will give excellent results.

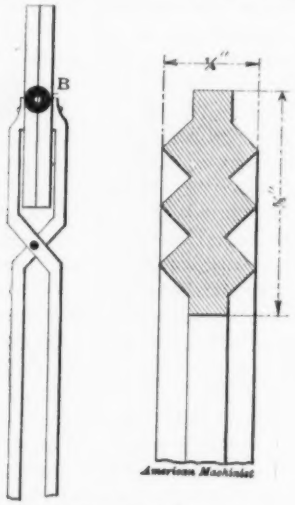
We charge our rotary lap when not in motion by sprinkling abrasive over the surface and rubbing it in with a piece of round iron held in both hands. Our surface lap is used for finishing only, and is also a gray-iron platen covered with lead; we charge it the same as the rotary lap.

Grooves and checks *may* be fallacies; we do not use them, neither do we have any trouble with "bird's-eyes."

ALBERT J. DELILLE.

Molding Lead Gaskets.

Having had quite a lot of trouble, to say nothing of expense, with various kinds of gaskets for the hand-hole plates of



MOLDING LEAD GASKETS.

water tube boilers, I did some experimenting with home-made gaskets, with very satisfactory results. The sketch of my mold, which I made by facing up a pair of gray-iron disks in the lathe and turning a groove in each to conform to the section of the gaskets, is here shown in enlarged (double size) cross-section. I make the gasket about ¼x⅝ inch, as shown. There is a central dowel-pin riveted in one disk and fitting the other rather snugly. The ends of the tong-like handles are forked and riveted loosely to the disk, with two rivets in each disk to prevent their turning. *B* shows the pouring gate.

I find a pl mber's furnace very convenient for melting the lead and also very handy for heating the molds before starting the work. Use the lead hot, and adding a small bit of tallow candle occasionally will help the cause along. Usually the first four or five gaskets will refuse to run complete, but as the molds get hotter the trouble all ceases. I have made a hundred of these gaskets per hour without a single bad one after the molds were thoroughly heated. In recasting old gaskets I find a loss of about 4 to 6 per cent. in the lead. The gates are cut off with a pair of tin snips, and the gaskets are pressed into oval shape with the hands. I have made these gaskets with a square, cross-sectional shape, presenting a single corner to the hand-plate and boiler head, but I like the form here shown better.

THOMAS G. VAN SANT.

How We Got a Pattern Shop.

The pattern shop came about in the first place because it was a necessity. Some things may be because they are somehow wanted before they are needed, but it can be safely said that when a little machine shop starts a foundry and then a pattern shop it is because the need of these things has become so great that they are no longer conveniences but necessities.

The foundry came first. That was natural. It was a very humble foundry, but humble as it was, it had to have a pattern once in a while. Many castings can be made from old ones; more than one thinks at first, but there is a limit. At first this limit had been bridged over by picking up some kind of a woodworker and getting him to do any work that was beyond the skill or the tools of the machinist himself. I suppose the starting of that pattern shop really dated back to the time when the machinist bought a square, a saw, a carpenter's hammer (he wanted the claw to pull out nails; if it had not been for that he would have gotten along with his machinist hammer), bits, planes and a draw knife. These were enough to let him do a job of pattern work that very rightly came under the classification of "wood butchering," but which often served its purpose in furnishing something which the shop could then make into shape to do the work.

For the rough repair jobs, where a man was broken down and did not mind the looks of things, just so that they would do his work, this kind of pattern work did very well; but as time went on some work came to the foundry so often that it would pay to have better patterns for it. These makeshift patterns had a way of not staying in shape and of falling to pieces, which was a never-ending provocative of despair to the unfortunate molder who had to try to use them, and of wonderment to the machinist.

Sometimes it was possible to get track of a job which would furnish a nice lot of work to the machine shop but which required castings, and the castings of course had to be made from patterns. If the patterns and the castings were made outside, the profit of the job was very apt to stay with them, instead of coming to the machine shop.

There was a local patternmaker who used to be out of work a considerable portion of his time. He was a good worker but a slow one, and, added to this, he had a habit of getting drunk whenever the notion took him and he happened to have the price, so if work was not good in the town he was often to be found at leisure It came to be the fashion that in his spare moments, when he was in condition to work, he could be found in the little pattern shop at work. If it wasn't on a job that was wanted at once it was on some stock pattern which experience had shown would be needed many times over in time to come.

An old lathe which had seen much service in machine shops and had finally been put out of commission by a fire was rigged up to do duty as a wood-turning machine, and it was followed by a jig saw. A jig saw is not the most speedy machine in the world, but it has an adaptability that makes it very useful where the most of its time it has nothing to do. Where many one-job patterns are made and simply cut out of a solid piece instead of being built up, as should be done if they are intended for continuous work, a jig saw with a stock of various sized saws is hard to beat. With more facilities came a reaching out after more work to keep them going, and when work for the pattern shop got to be the common condition there it was found that it did not do to have to depend on a patternmaker who worked there by spells only and when he could not get work elsewhere, and a man was hired who had no other job. It took hustling to keep him going, and then it kept him hustling to keep up, and before long he was telling how much more he could do if he had more things to do with, and as a result a small sized trimmer was added to the equipment.

He kept growling about the time lost in ripping up stock, and after explaining how little expense it would be to make a saw table by using some patterns already made for other work for the framework, one was started as a filling-in job for the establishment. A worm and worm-wheel that came in with some junk suggested that the table could be made to be raised and lowered, as well as to hinge to give ready access to the arbor, and they were utilized. As all sorts of woodwork was thrown on to the pattern shop and it began to be crowded, hints of the uses a common carpenter could be put to in keeping the rough work

out of the way began to be heard and soon one was hired, and then there was more hustling to keep both of them going.

When the foundry and the pattern shop were slack, all hands were busy thinking of something that it would be possible to make to keep things going to keep the men at work. Jobs were often taken on very close margin, and indeed sometimes on no margin at all, and the men knew it, because when a job was in sight both the pattern shop and the foundry were consulted as to the cost of doing their part of the work; then as likely as not the job had to be taken quite a ways below their estimate in order to bring the price down to where the customer felt he could afford to have it done at all. Every job did not pay, but enough of them did to keep the balance on the right side as an average, altho it was a very small balance at times.

Gradually the machinery was paid for, and the need of more was felt. A band saw took the place of the jig saw, and then a buzz planer joined the band. About this time the pattern shop began to get too big for its place, and besides that the machine shop wanted the room, so a new place was provided for it. This meant that independent power must be provided, and a gas engine was put in and the pattern-making gang had to learn to run it. That was rather tough, for a woodworker dislikes the black dirt of machinery; but it was a necessary evil and they did the best they could, and stood the chaffing of the men in the machine shop, who used to "roast" them "to the Queen's taste" when they got stuck and had to call for help. That got to be very seldom as time went on, altho it was quite often at first. There is lots of difference between making a set of patterns for a gas engine and making that same gas engine run after it is made from those patterns.

The grindstone had come along near the beginning, for that stone in the machine shop was never in shape "to grind a real tool on. It is all right when only a rough chunk of steel is used." The machine shop knew that such talk was the rankest heresy, but the fellows were glad when a man from the pattern shop did not have to come and get in their way when they wanted to grind.

As the volume of work increased and the men got to be more numerous a larger trimmer was put in, and it was soon followed by a couple of vises which could be twisted into all sorts of positions and catch all sorts of pieces and hold them in all sorts of ways. A band-saw filing machine "filled a long-felt want," only the boys did not know they felt it until they heard of the machine, and to help it out a saw-setting machine was put near it. That made the finishing touches for the band-saw. It had started with the equipment for brazing the saws.

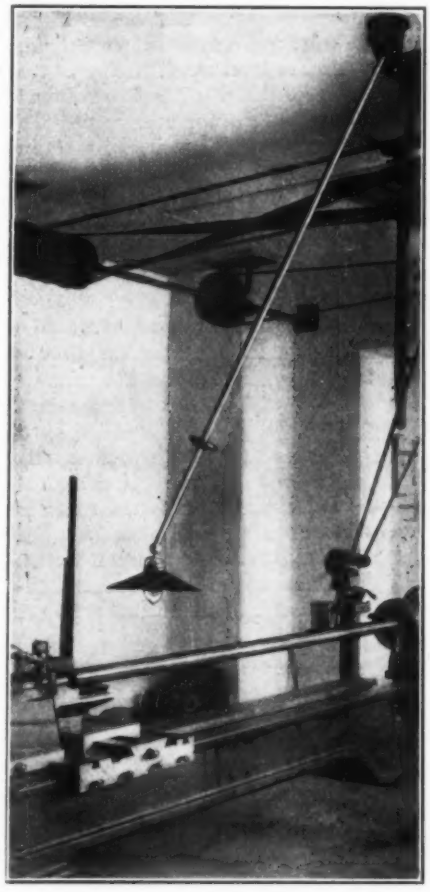
An old drill press that had been superannuated in the machine shop and put on the retired list was appropriated and good use was made of it as soon as a chuck was arranged so that bits could be used as well as drills.

The establishment now consists of four men and a boy, and it grew to be what it is by the pressure of circumstances and not from any far-reaching plan as to what a model pattern shop should be, but, looking at it as it is, and taking into consideration all of the surrounding conditions, it fits into its place as well as if it had been especially planned for that place by an expert. WILBER.

The Hoegner Workshop Pendulum.

BY DR. ALFRED GRADENWITZ.

A device for holding lights in any desired position is being brought out by



THE HOEGNER WORKSHOP PENDULUM.

Messrs. Hoegner & Weller, of Leutsch, near Leipzig, Germany.

The "workshop pendulum," as the device is called, allows an electric lamp to be readily moved both laterally and—in the case of a special type—vertically to a great extent, and held in any position desired; while the space required at the ceiling is quite small, the wires being run thru the tube constituting the pendulum.

The pendulum is suitable for holding lamps for illuminating desks, drawing tables, vertical drawing boards, lathes, etc., in fact, wherever a movable lamp is required.

As seen in the illustration, the device is a tubular pendulum fitted with a friction joint at the upper end, allowing a swinging movement to be imparted to the pendulum, the friction being sufficient to hold the pendulum and its lamp at any desired position. Immediately above the lamp there is a further friction joint, by means of which the lamp is given an inclined position. By inserting a short piece of flexible metal tubing between the lamp and the pendulum, the lamp is always maintained in a vertical position.

Ningpo Varnish.

The following information sent to *Consular Reports* by F. D. Cloud, United States Vice-Consul at Hangchau, China, should be of interest to patternmakers especially. It would seem that samples of the varnish spoken of should be procured and experimented with.

"I desire to call attention to what is known among foreigners in this country as 'Ningpo varnish,' made from the sap of the 'varnish tree' (*Rhus vernicifera* or *Vernix vernicia*), which grows very extensively in western and southwestern China. The name was originally given because varnishers from Ningpo were more skilled in its preparation and use than others. The sap is gathered in the interior and brought to Huichoumin, in the southern part of Anhui Province, where it is refined and then distributed to all parts of the Empire. It is sold by the retailer in the raw or pure state—that is, the pure, refined sap, and in the prepared form, which is a mixture of the refined sap with certain proportions of 'wood oil.' It is in the proper blending of these that the skill of the varnisher is shown, as the color desired, the wood to be varnished, moisture of the atmosphere, and temperature are conditions that enter into the problem. The uses of the varnish are manifold. Wherever varnish is desired the Ningpo kind is used, and it is so far superior to the ordinary varnish of commerce as to be in a class by itself. It is particularly adapted to floors, tables, cabinets, and such articles as are in constant use. It is also excellent for furniture of all kinds, as it does not scar easily and may be scrubbed with boiling water without the slightest injury to the very high polish of which it is capable. The greatest drawback to its use is the danger of 'lacquer poisoning' to the workmen who use it. This is similar to 'ivy poisoning,' and when the sap is fresh is regarded as rather dangerous. Once the varnish is dry there is no danger whatsoever. It may be used in any climate that has a rainy season or wet weather. The varnishing is always done during the wet season and is allowed to dry slowly as the moisture of the atmosphere decreases."

It is stated that the breaking of the bottom end bolt on the "St. Louis"—referred to several times in our columns under the caption "Accident to the St. Louis"—cost the American Line $63,400.

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Mr. Warner and Professor Burr on the Panama Canal.

There was an unusually large attendance at the monthly meeting of the American Society of Mechanical Engineers held at the Society's house on the evening of March 2, when Mr. Worcester R. Warner, of Cleveland, Ohio, addressed the members on the subject of the Panama Canal. Mr. Warner, some time ago, went to that country with a committee appointed by Congress for the purpose of investigating the canal situation, tho Mr. Warner himself accompanied it as a private citizen only. Naturally, he observed things pretty closely, and in addition gathered a fund of anecdote and reminiscences, the telling of which made a very pleasant evening for his auditors.

Mr. Warner proved to be strongly in favor of the sea level canal, stating as the chief reason for this that it had been found that a dam necessary for constructing the canal under the present plan and to form an inland lake which should constitute a portion of one of the higher levels of the canal would be extremely expensive, for the dam will be 2,000 feet long and it has been ascertained by borings that it probably would be necessary to go 150 feet below sea level for the foundation. Mr. Warner said, moreover, that the French company had already reduced the extreme hight of the cutting from 275 feet, which it was originally, to 150 feet, which is the extreme depth yet to be dug. A goodly portion of the lower levels of the canal at each end thru the swampy territory has been dug, but will have to be enlarged very much if present plans are followed.

At the conclusion of Mr. Warner's address, President Freeman, who presided, called upon Professor Burr of Columbia College, who is a member of the Panama Canal Commission and who, having been over the ground and made a thorough study of it, is very well informed regarding it. In relation to the action of the commission, Professor Burr said that the true inside history of the original recommendation of the commission in favor of the Nicaraguan route was based upon the fact that the French company existing at that time was altogether unreasonable in regard to its expectations or ideas of what should be received by it for the partially completed work. The management then in power demanded something like 109 million dollars, whereas the commission believed that it was worth about 40 millions of dollars. The officers of the French company evidently believed that there was no practicable route except the Panama, and that the United States would be obliged to come to that route, no matter what its cost might be. The report of the commission, therefore, was in favor of the Nicaraguan route, tho, as Professor Burr said, it was apparent from the report itself that, from an engineering standpoint, the Panama route was preferred. Shortly after the report was made the French company elected a new set of officers, telegraphed that they were then ready to accept the commission's estimate of the value of the canal, and it was finally actually purchased at the commission's estimate of 40 millions of dollars.

Professor Burr also expressed himself as being strongly in favor of a sea level canal, and among the reasons for this stated that the best estimate the commission could make, originally, as to the cost of excavation was eighty cents per cubic yard. It has been found since that this work would probably be considerably less than eighty cents and would be about fifty and perhaps as low as forty, so that on this account the construction of the sea level canal would not exceed the original estimated cost of the canal by nearly as much as would otherwise have been the case. He believed it ought to be apparent to anyone that the sea level canal when finished would have manifest and very great advantages over a canal with locks; especially, he thought, with regard to the danger of accidents happening to vessels in going thru, in respect to the time required for passage thru, and also in respect to the facilities for enlarging the canal should it be found necessary to do so in future; stating that in the case of a sea level canal the enlargement would be very easily effected, without interfering with traffic, whereas with a canal having locks the work of enlargement would necessarily interfere with traffic considerably, and would be exceedingly expensive.

It has been stated in the public press that the change of plan at this time to a sea level canal would postpone the completion of the canal by about ten years, and prolong the monopoly of the Trans-Continental Railroad by that period. This is said to be the reason why certain men who from the beginning have strenuously opposed the construction of any kind of a canal, whatever, are now advocating the change of plan to a sea level canal. While there may be something in this, yet we believe that no one who heard the matter discussed by Mr. Warner and Professor Burr on the occasion referred to could doubt that there are good engineering reasons for the change to a sea level canal, and we think also that no one would charge that either of these gentlemen could possibly be affected by any improper motive in their advocacy of what they sincerely believed to be the best thing.

Quenching and Restoring Compounds for Steel.

Several readers of the AMERICAN MACHINIST who are in the business of manufacturing machinery, have sent us letters received by them from a firm offering for a specified sum to send a specified number of gallons of a specified mixture for quenching steel, and which mixture, it is claimed, produces the most remarkable effect upon this steel, making it much better than if quenched in water or in any

other compound. In a circular accompanying one of these letters, it is stated that it is the belief of the makers of the compound that it is identical with the quenching compound which was used in olden times by the makers of the wonderful Damascus blade and other remarkable things supposed to be non-duplicatable by modern methods. All those who have sent these letters to us have done so evidently under the impression that this proposition is some sort of a bunco game. Of course everyone is entitled to his own private opinion in such matters as this. There is no positive proof that the proposition is otherwise than straight; but as we have said before the utility of any hardening or quenching compound is extremely doubtful. It has been shown many times that where a compound has been supposed to produce good results, equally good results have been produced without its use, and by the observance of the ordinary care and precaution that have been taught by years of experience in working steel. Particularly does this apply to the compounds which have been recommended for restoring burnt steel; it having been shown that where burnt steel has been reheated to a mild heat and quenched in water it was restored to about the same extent as tho it had been plunged in the so-called restoring compound.

One good result of the recent adoption of the new constitution, by-laws, etc., of the American Society of Mechanical Engineers is shown in a recent notice to the members regarding the limit of time within which articles can be received for publication. This matter is now in the hands of a Publication Committee which is in a position to enforce the rules which experience has shown to be necessary in order that papers to be presented at a given meeting may be prepared in time to be sent out to the membership for study and the preparation of discussion. This is a thing which has sadly needed attending to for many years, and while it may occasionally happen that a paper will be postponed from one meeting to another by the strict enforcement of the new rule, it will in the end be a good thing, because it will stimulate the presentation of carefully prepared discussions and such discussions are the feature of the meetings which seems usually to be most valuable.

The Metropolitan Railway & Carriage Company, an English corporation, is about to establish a plant at Tolosa, Argentina, for the manufacture of all kinds of rolling stock.

At the Marion (Ohio) cemetery a granite ball said to weigh two tons is slowly turning upon its pedestal. In five years a point on the surface of it has moved 13¾ inches. The action is attributed to the alternate warming and cooling of the sunny side.

New Tools and Machine Shop Appliances.

SPECIAL AUTOMATIC DRAWING PRESS.

The half-tone, Fig. 2, shows a special automatic drawing press recently built by the E. W. Bliss Company, Brooklyn. It

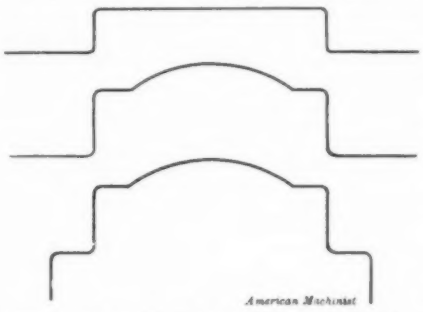


FIG. 1. SUCCESSIVE DRAWING OPERATIONS.

was designed for performing at each stroke the second and third operations indicated in Fig. 1, the blanking and first drawing being done in another press. The blanks as thus prepared are placed on the table *A* and successively slipped on to the revolving dial *B*, the face of which is level with the table. The dial is operated by the round belt *C*, which runs in a groove on the projecting hub of the flywheel and is led by suitably placed idlers to the pulley *D* on the vertical spindle of the dial. The partly formed shell is carried by the movement of the dial against the automatic stop-fingers *E*, which allow but one shell to pass at a time. These fingers rise at a certain time and the shell enters the grip-jaws *F*, which close upon it and carry it to the left and under the first punch G. As the press slide descends the jaws open and the shell drops into the die and undergoes the first operation. When the press slide rises the jaws *F* return to their initial position and the jaws *H* take their position opposite the shell which has been operated upon. They then carry this first shell under the second punch *I*, while the fingers *F* bring a new shell under the first punch, and thereafter both drawing operations are performed simultaneously at each stroke of the press. After the second operation the shell is slid along until it is clear of the feeding apparatus and drops into the

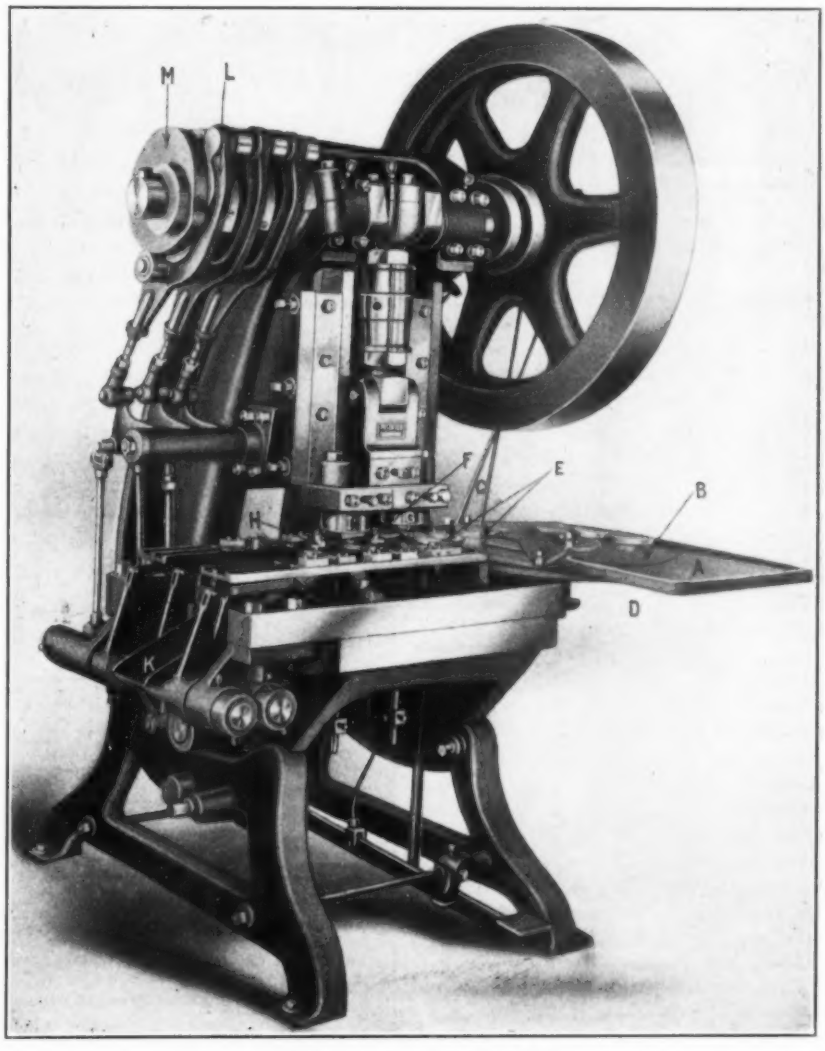


FIG. 2. SPECIAL AUTOMATIC DRAWING PRESS.

chute *K*. The mechanism which operates the slides and fingers would require a long and elaborate description, which we are not warranted in going into, but much of it will be easily understood from the half-tone. The yokes *L* straddle the main shaft and are moved up and down by the cams *M*, each having a different time or range of movement. From the yokes the motion is transmitted by the rods and tumblers to the horizontal shafts below, whose levers connect with and operate the slides. The normal speed of the press is seventy-five strokes per minute, and it weighs 4,000 pounds.

A NEW BATH UNIVERSAL GRINDER.

There are few machines, at least in the machine-tool line, which have so clear a right to appropriate to themselves the word "universal" as has the grinder shown in the half-tones herewith. The Bath grinder was described and copiously illustrated by us at page 898, Vol. 24, and the universal work-holder used in connection with it was described and illustrated in many of its applications at page 1162 of the same volume. The machine here shown, while retaining all the valuable features of the previous exhibit, embodies additional desirable facilities and has throughout a rigidity and precision all its own.

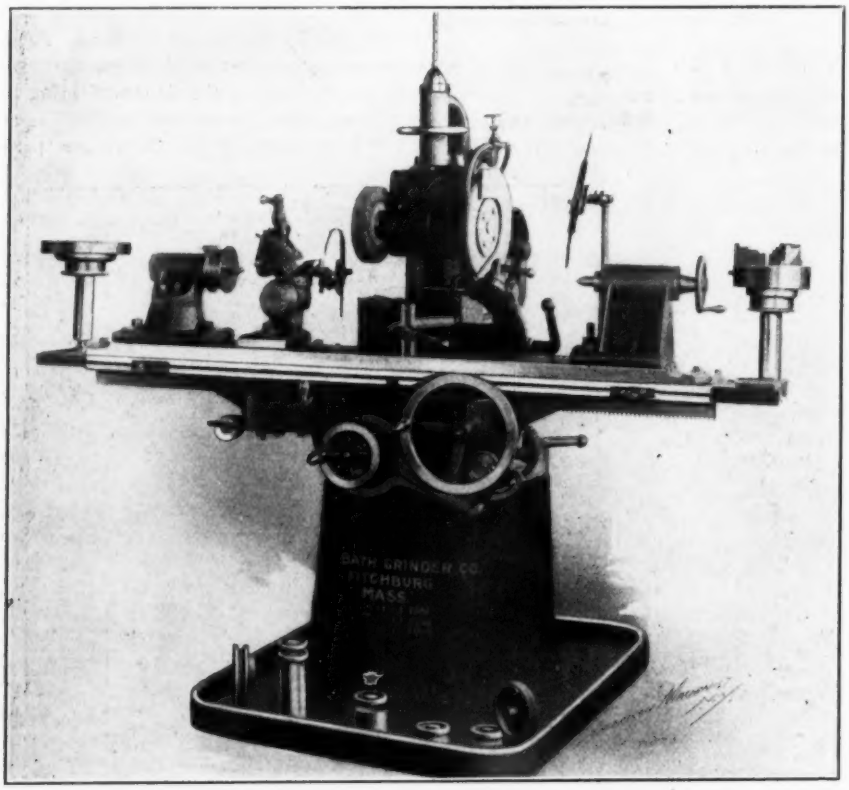


FIG. 1. FRONT OF BATH GRINDER.

Fig. 1 shows the front, with a number of the machine appurtenances, and Fig. 2 the rear of the machine. On the top of the base is a slightly projecting flange, and upon this is another flange with graduated edge, the latter being the base of the upright slide. The upright slide with this broad foot is firmly bolted to the base, so that the slide carrying the wheel mounting has all the stiffness of a solid casting from the bottom. The base for the cross and longitudinal work carrying slides is of the same diameter as the other flanges and the depth of this casting is seen in Fig. 2. It can be swung around at any angle and is clamped by the handles seen in Fig. 2. The cross-slide has a very long bearing and never overhangs the bottom bearing. The longitudinal slide is wide and has extra long bearings. The table has two T-slots for clamping purposes and a V-groove in front for guiding headstock and footstock.

The headstock is pivoted and is graduated in degrees. The headstock center quill rotates and the center can be used as either a live or dead center. The pulley is made in two pieces and is held in place on its conical bearing by a detachable flange, and by the turn of a screw it is changed from a dead center pulley to a live center pulley.

The footstock has a spring center, the quill is long, 2 inches in diameter and bored for No. 3 Morse taper for the centers. On the front of the footstock is a flat projection for clamping the diamond tool-holder for truing the wheels, or for clamping the tooth-rest stand in cutter grinding. The diamond is usually kept in position.

The longitudinal slide can be locked at any position for shoulder grinding or cutter work. The slide is moved by a micrometer adjustment when grinding the ends of cutter teeth. Back of the large hand-wheel is the power cross feed attachment for surface grinding.

Upon the front of the upright frame is mounted the spindle head slide, having a movement of 7 inches. A reading of the movement is given to .001 inch at any position. By this system clearances are obtained for all kinds of cutter and reamer grinding and locations for various other operations.

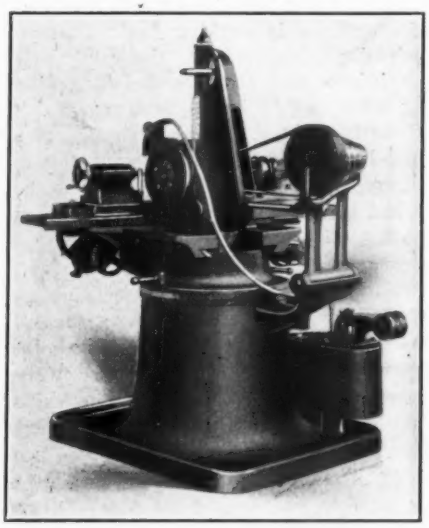


FIG. 2. BACK OF BATH GRINDER.

The spindle-driving cone frame is arranged to work automatically, keeping the same tension of belt at any position of the wheel-head slide. An independent tightener is also provided for the horizontal spindle belt.

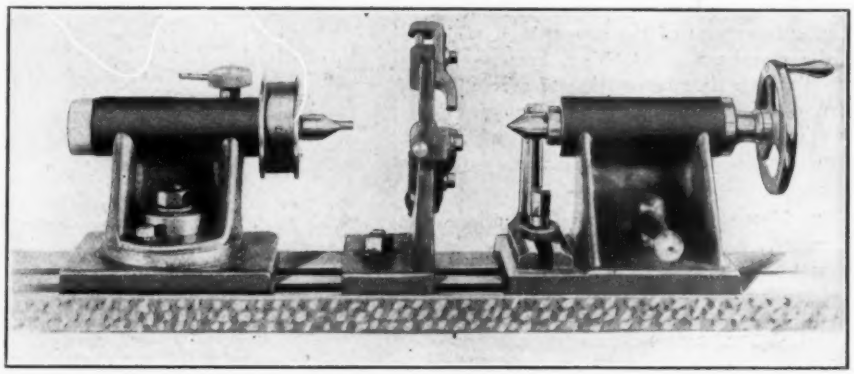


FIG. 3. HEADSTOCK, FOOTSTOCK AND STEADY-REST.

Both No. 1 and No. 2 machines are provided with water attachments, and special care has been taken to protect all bearings from grit and water. On the No. 1 machine the spindle-head slide is counterbalanced for screw and lever movements. The spindle slide also carries an adjustable gage stop for gaging length of stroke.

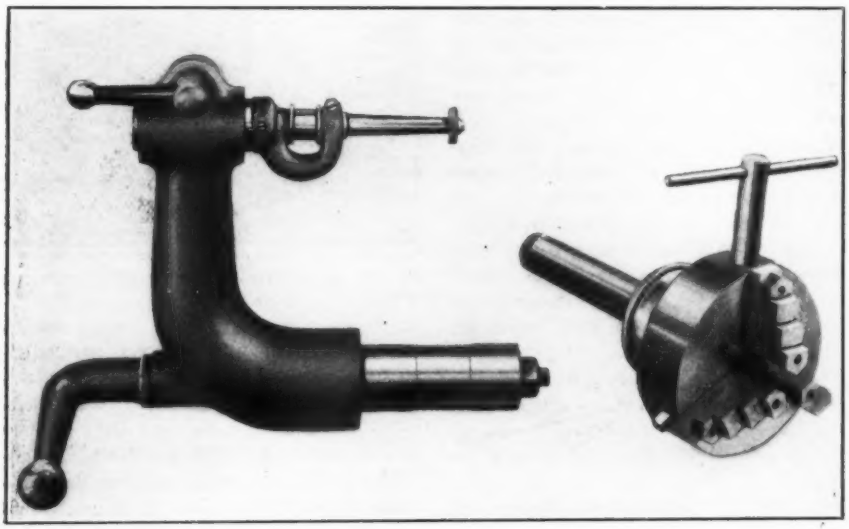


FIG. 4. INTERNAL GRINDER AND CHUCK MOUNTING.

The advantage of the counterbalance is a quick lever sensitive hand movement for cutter sharpening.

Fig. 3 shows the headstock, footstock and steady-rest for the No. 1 machine with the diamond for truing the wheels. Fig. 4 shows the internal spindle attachment with driving pulley and chuck mounting. Fig. 5 is the universal holder with the flange plate and vise mounted on the holder and

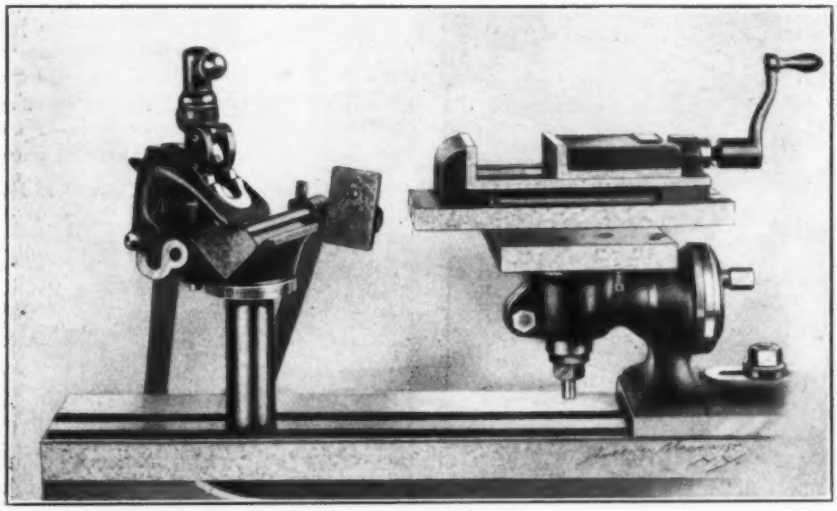


FIG. 5. UNIVERSAL HOLDER WITH VISES FOR FLAT AND CIRCULAR WORK.

the V-vise removed from the holder. The V-vise and flange-plate stems interchange; in some operations they are used together, and in others independently. The horizontal vise has a T-slot in the bottom, which permits it to be swiveled or adjusted on the flange plate and clamped by a square-head bolt which passes thru the stem of the flange plate into the T-slot in the vise and is clamped by a hexagon nut.

The applications of this machine are so numerous that it is useless to attempt to show any of them, altho a great number have been photographed. It grinds plane surfaces with micrometrical adjustments and automatic feeds, also cylindrical and conical surfaces, both external and internal. It grinds reamers, milling cutters, saws, etc., of every shape. The makers of the machine say that they have never found any cutter which they could not grind. The appurtenances provided enable all clampings and adjustments to be made with marvelous celerity and facility. Fig. 6 is perhaps as suggestive as any operation which could be selected. Here is shown the grinding of a turret lathe forming tool held in the vise mounted on the universal holder. The grinder is built by the Bath Grinder Company, Fitchburg, Mass.

CORRUGATED EMERY WHEELS.

The engraving herewith shows the appearance of an emery wheel which has been corrugated in the manner shown, and the effect of which corrugation is, apparently, to greatly increase the rate at which the wheel will remove metal. The corrugations are produced by a tool similar to the Huntington emery wheel dresser, but which is arranged with its cutting points in such a way as to produce the spiral grooves which may be likened to a nurled surface, and are produced in much the same way. The effect of this corrugating seems to be very marked. Numerous tests have been made of wheels before being corrugated, and after being corrugated,

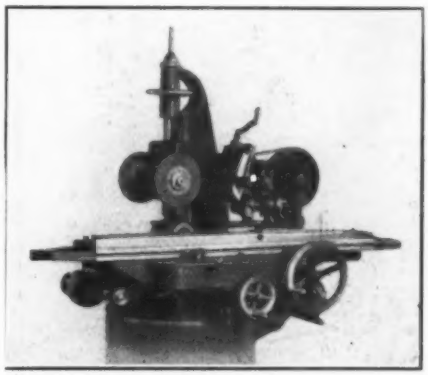
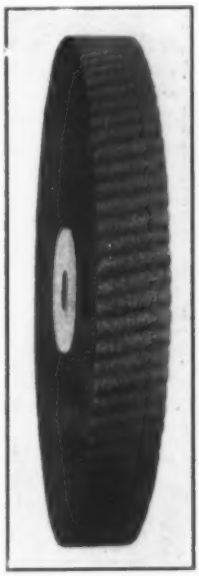


FIG. 6. GRINDING A LATHE TOOL.

working in various materials and under various conditions, and the general conclusions seem to be that the corrugated wheel grinds with much less heating of the work, grinds much more rapidly, with a great deal less tendency to glaze, and wheels that are much harder than would otherwise be possible are made entirely practicable; this increased hardness compensating for the more rapid wear which would otherwise take place, while at the same time it of course makes the wheel stronger and safer. We have seen a gray-iron plate three-quarters of an inch thick ground by one of these wheels, first be-



CORRUGATED EMERY WHEEL.

fore being corrugated and then after the wheel was corrugated, the iron plate or test piece being in each case pressed against the wheel by the same weight sus-

FIG. 1. GENERAL VIEW OF BLUEPRINT WASHING AND DRYING MACHINE.

pended over a pulley, and allowed to remain in contact with the wheel for thirty minutes, running of course at the same speed in each case. When the wheel was not corrugated, the depth of the grinding, within the thirty minutes' time, was 1¼ inches; after corrugating, the depth of the grinding within thirty minutes' time was 3 inches, or a net gain of 140 per cent. This of course does not prove that all corrugated wheels, on all kinds of work, will give similar results, but this result is

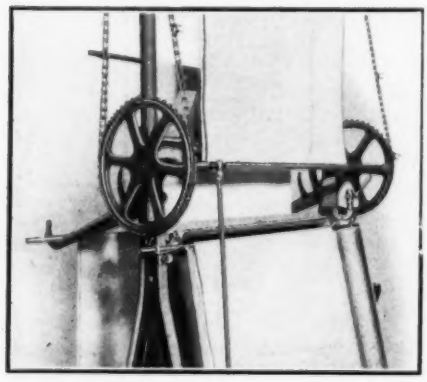


FIG. 2. LOWER PRINT BEING WASHED.

sufficiently remarkable considered by itself; tho we remember that it does not absolutely prove anything except what is directly and specifically shown by it. However, a great number of other tests of the wheels have been made with results that are in various ways very interesting. The wheels are made by the Corrugated Grinding Wheel Company, of Philadelphia, Pa.

BLUEPRINT WASHING AND DRYING MACHINE.

Fig. 1 shows a general view of the machine which was designed for the purpose of reducing the cost of producing large quantities of blueprints, and to do away with the large washing tanks and drying paraphernalia usually occupying a great deal of space in a blueprint department. The construction effects economy in floor space, avoids wet, sloppy floors, and thoroughly dried prints are secured in much less time than by the old process.

The washing of the prints is accomplished by a spray of running water flowing over the treated side of the paper only, removing the surplus ferroprussiate in the quickest time possible. Prints are not soaked thru as in the old process, as the water coming in contact with one side of the paper only and for but a very short time, leaves it in a condition to dry in about one-third of the time usually required.

The print is placed on the drying rod before washing and remains there during the entire process of washing, wiping and drying, making it unnecessary for the operator to wet his hands. He can therefore work to and from printer and washer without difficulty, washing sheets as fast

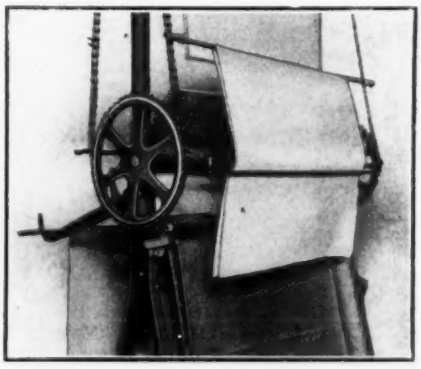


FIG. 3. PRINT PASSING THRU WIPER.

as printed, as the time required at the machine is but a fraction of a minute. As it hangs in the washing tray on the drying rod, Fig. 2, the water flows down both sides of the doubled print, half of it on the side toward the operator and the balance between the print and the back of the tray. When the front portion of the print in view of the operator is completely washed the balance is in the same condition.

The surplus water is removed by a device, Fig. 3, which wipes the print as it is moved upward by the chains. Each print in turn passes thru this wiping device and over the top of the machine till it is finally deposited into the drying rack, Fig. 4, at the back of the machine, from which the dry prints are removed as required. Fig. 5 shows an enlarged form of drying rack by which the prints are automatically spaced by means of a chain. A gas heater is also supplied to expedite the drying process.

These machines are built in four sizes to

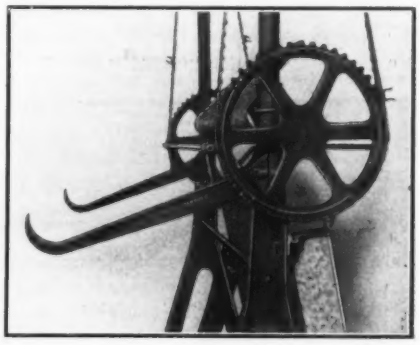


FIG. 4. WEDGE-SHAPED BRACKETS REMOVING DRYING RODS FROM SPRING CLIPS.

handle prints from 24x48 inches or smaller up to 42x100 inches by C. F. Pease, 172 to 182 West Locust street, Columbus, Ohio.

A PIPE BENDING MACHINE.

The half-tone shows a pipe bending machine the operation of which is easily un-

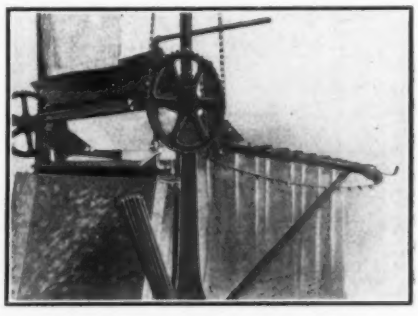
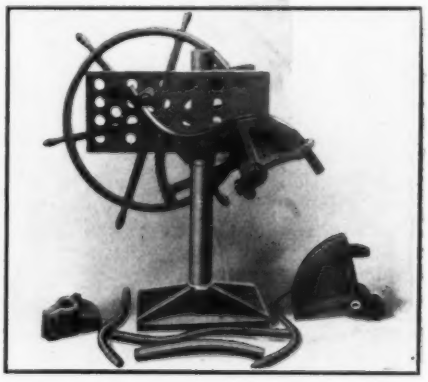


FIG. 5. ENLARGED DRYING RACK.

derstood. The hand-wheel carries a pinion which works in a geared quadrant the shaft of which carries the pipe bending quadrant. One of the latter is made for each diameter of pipe to be bent, the semi-



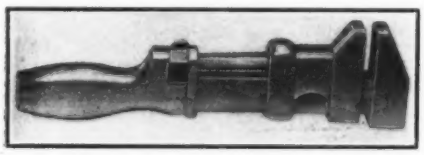
A PIPE BENDING MACHINE.

circular groove in its perifery hugging the pipe on the sides and preventing its flattening. The first end of the pipe to be bent is held by the U-shaped clip and the projecting portion comes against a roller on the movable stud, as shown. This

stud may be placed in any hole of the plate, according to the bend required. One man with this machine bends cold pipe of sizes up to 2 inches in diameter. Pipes galvanized, tinned or otherwise coated can be bent without breaking the coating. This machine is built by Pedrick & Smith, 222-226 East Girard avenue, Philadelphia.

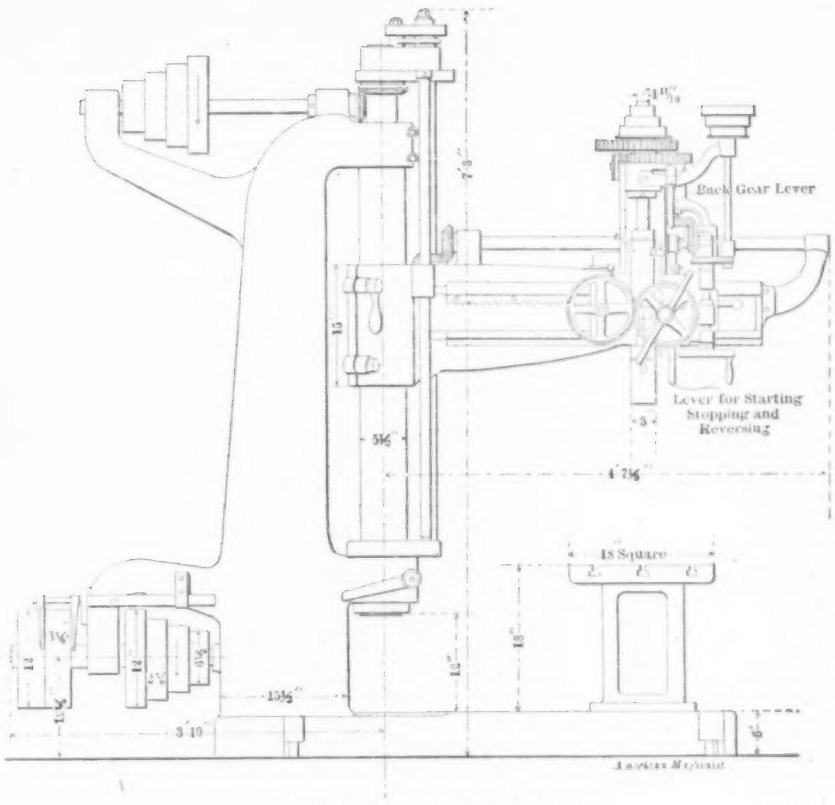
A QUICK-ACTING MONKEY-WRENCH.

In the wrench shown, the usual screw and nut are replaced by a screw with an interrupted thread worked by means of a



QUICK-ACTING MONKEY-WRENCH.

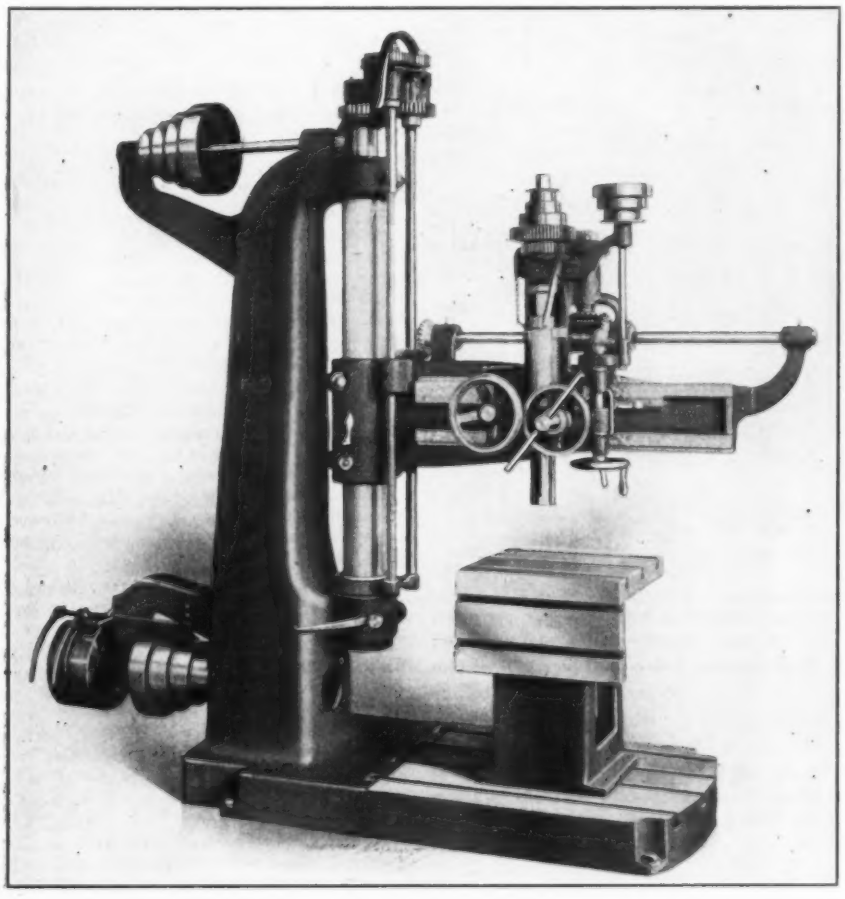
thumb piece. The interrupted thread of this screw engages with a similar thread in the jaw. By turning the thumb piece in one direction the jaw may be slid in or out, and by turning the thumb piece at right angles to this position the jaw is instantly and firmly locked. It is claimed that the jaw is not liable to jar open, as with the ordinary monkey-wrench. The discarding of the nut allows the jaw to be opened wider than would be the case were the nut retained. These wrenches are made in four sizes, from 8 to 15 inches, by the Bay State Tool Company, 294 Washington street, Boston, Mass.



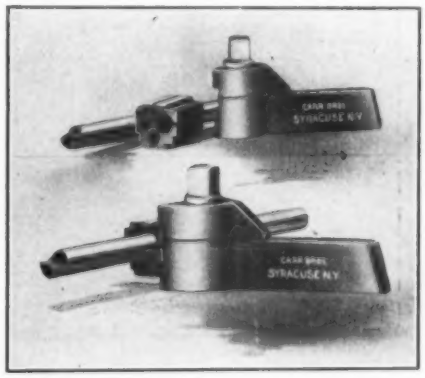
ELEVATION OF A RADIAL DRILL.

A RADIAL DRILL.

The illustrations show the latest development of the radial drill built by Roos & Mill, 2630-2634 Colerain avenue, Cincinnati, Ohio. The base and main column are cast in one piece. The spindle is provided with a reverse for tapping operations. All levers for starting, stopping, reversing and for throwing the back gear in and out are conveniently located near the position occupied by the operator. The 3-foot machine drills work above the table line to the center of a 6-foot 2-inch circle, and upon the base to the center of a 7-foot 8-inch circle. The general dimensions will be found on the line cut, which is to scale. The spindle is bored and reamed to receive Morse No. 4 shanks.



A RADIAL DRILL.



COMBINATION BORING TOOL HOLDER.

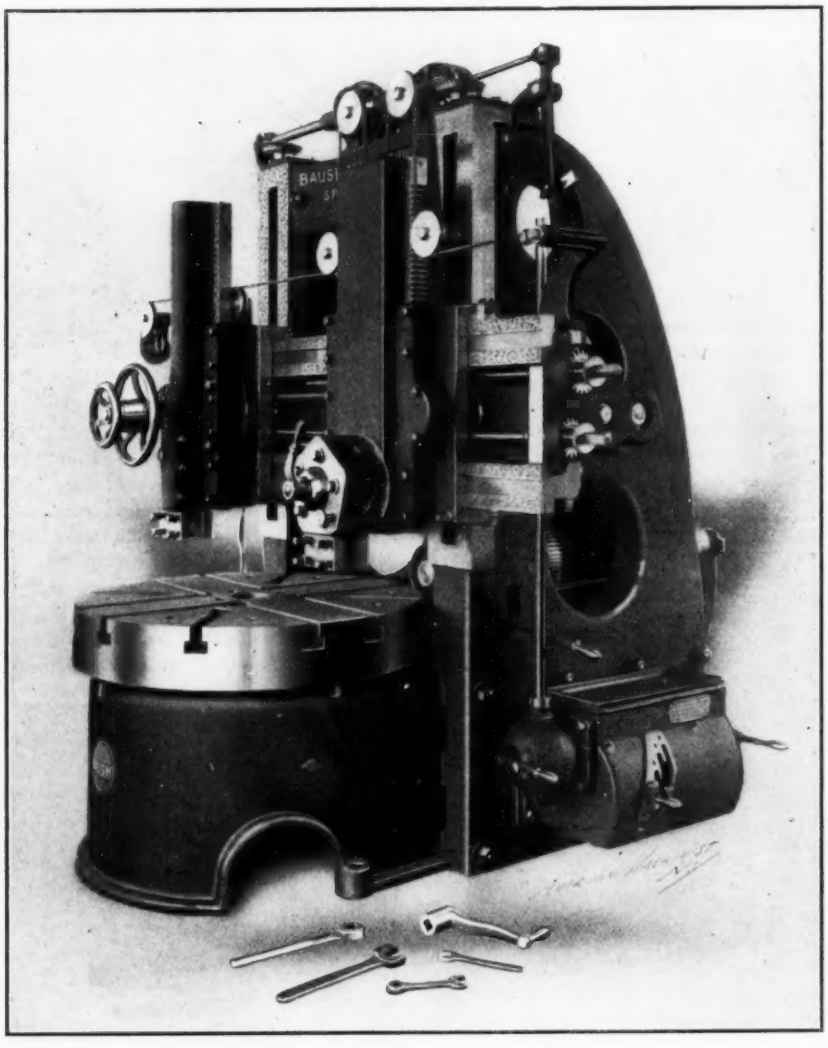
COMBINATION BORING TOOL HOLDER.

The half-tone herewith tells the whole story of a new and handy boring tool holder. The shank is fastened in the tool-post in the usual way and then the block may be clamped by the dovetail on either

of its four sides according to the size of the tool to be used, the act of clamping the block also gripping the round body of the boring tool. The block is made to take ¼, 5-16, ⅜ and ½ inch round steel. The tools can be set to project any desired length and can also be rolled to any desired position for cut and clearance. This holder is made of steel, drop forged, nicely finished and case hardened, by Carr Bros., Syracuse, N. Y.

A 42-INCH BORING AND TURNING MILL.

The half-tone shows a boring mill built by the Baush Machine Tool Company, Springfield, Mass. It will take work 44 inches in diameter to a hight of 37 inches under the cross-rail and 31 inches under the tool holders. The table is 42 inches in diameter, powerfully geared with planed steel teeth on table and pinion giving ten speeds ranging from 6 to 20 revolutions per minute. On the under side of the table there is an outer bearing nearly equal to the diameter of the base. The spindle is 10 inches in diameter and 20½ inches long. It has a straight bearing which acts in conjunction with an angular bearing to resist side strains. There is also a thrust ball bearing on the lower step which prevents lifting and relieves the friction when heavy cuts are taken. The turret slide can be set to bore or turn or will cut threads 8 and 11½ to the inch. The turret is 10 inches across the flats and the holes are 2 5-16 inches. The heads are independent in movement, both as to direction and amount of feed. The left-hand head can be set at any angle and either head can be brought to the center. They have a vertical movement of 24 inches. The heads are operated by steel feed screws with split nuts which can be opened, permitting a rapid ratchet and pinion movement. The feeds are positive with fifteen changes, from 1-64 to 61-64 inch horizontal and 1-64 to 9-16 inch angular and vertical. The cross-rail is raised and lowered by power which does not require the rotation of the table. A brake band operates the main cone, stopping the table instantly. A plain table as shown is usually furnished, but a three- or four-jaw universal or independent chuck can be supplied, and with two regular swivel heads if desired. The countershaft has tight and loose pulleys for 4½-inch belt. The machine is self-contained and does not require an expensive foundation. It requires a floor space 8 feet 5 inches by 9 feet, and weighs 16,200 pounds.



A 42-INCH BORING AND TURNING MILL.

Personal.

Will our correspondent signing himself "Yorkshire" please send his address to the editor?

The Engineer Company, Western Union Building, New York, has established a department of consulting engineering, with John MacCormack, Embury McLean and John C. Quinn as engineering experts.

Charles M. Carson, formerly superintendent for the Whitcomb Manufacturing Company, of Worcester, Mass., has lately become superintendent of the Cadillac Automobile Company's plant, Detroit, Mich.

B. A. Schroder, for some time attached to the St. Louis office of the Crocker-Wheeler Company, has been placed in charge of the New Orleans office of the company. Mr. Schroeder succeeds W. P. Field, who has been transferred to the Boston office.

Our contributor, Herbert L. Towle, has opened an office at 150 Nassau street, New York, where he is consulting engineer, particularly for matters connected with internal combustion engines, motor boats and automobiles. He is also giving his attention to acting on behalf of purchasers of second-hand or other automobiles who may lack experience in these matters and may wish to avail themselves of a competent and experienced expert.

Business Items.

R. W. Ney, maker of disk grinders, etc., has removed his laboratory from Pine Plains to Kingston, N. Y.

The Robbins & Myers Company, Springfield, Ohio, has recently opened a new office in Chicago at 1107 Fisher Building, and has arranged with C. H. Norwood to represent it in the Chicago territory in its line of "Standard" motors and generators. The company will carry a complete stock of these goods in Chicago.

The Charles F. Elmes Engineering Works, Chicago, Ill., have purchased 139 feet on Morgan street, adjoining their present buildings, which now gives them a full frontage on Morgan street between Lake and Fulton streets. The purchase of this additional space was made necessary by the rapidly increasing business of this concern, the present quarters having been outgrown.

Riddell Brothers, Atlanta, Ga., have purchased the machine business of the Campbell Machine & Manufacturing Company, of Atlanta. It is their intention to make this the best repair and machine shop in Atlanta. Both members of the firm are men of practical experience, each having served in every position from apprentice to superintendent of machine and manufacturing companies.

The contract for the compressed air power plant to be used in driving the second pair of trolley tunnels under the Hudson River has been awarded to the Ingersoll-Sergeant Drill Company, which company has furnished all the compressors for subaqueous tunnel work in New York and vicinity. These tunnels, which are popularly known as the Cort-

landt street tunnels, for the reason that their New York terminal will be located on that street, are to be built by the Hudson companies, of which Chas. M. Jacobs is the chief engineer. The shield method of subaqueous tunneling will be used. The order includes five duplex air compressors. Three are low-pressure class "H" machines. The other two are class "HC" machines for high pressure. This makes thirty-eight Ingersoll-Sergeant air compressors, with a total capacity of 117,234 cubic feet of free air per minute, now used in building the various tunnels under the Hudson and East Rivers.

Manufacturers.

The Scranton (Pa.) Machine Works is building an addition to its plant.

The Wilmington (Del.) Sash, Door & Blind Company will erect a new plant.

The Winton Motor Carriage Company, Cleveland, O., will enlarge its plant.

The Bundy Adding Machine Company, Endicott, is putting up a new building.

The William Penn Cut Stone Company, of Duluth, Minn., will build a new mill.

The Blake Asphhalt Maintenance Company, Cincinnati, O., will erect a new plant.

The German Gelatine Company is soon to build a glue factory at Holland, Mich.

The Delivouk & George Machine Works, Chicago, Ill., have been damaged by fire.

The Pritchard-Strong Company, Rochester, N. Y., will erect a modern lantern factory.

The Crookston (Minn.) Pressed Brick & Cement Block Company will erect a plant.

The Nazareth (Pa.) Portland Cement Company will increase the capacity of its mill.

The Lobdell Car Wheel Company will erect an addition to its plant at South Wilmington, Del.

The Pacific Coast Pipe Company, of Ballard, Wash., will erect a plant, to cost $50,000.

The D. E. Binns Stucco Retarder Company's plant was destroyed by fire; loss, $10,000.

The Lookout Mountain Iron Company, Batelle, Ala., will probably erect a by-product plant.

The plant of the Pittsfield (Mass.) Spark Coil Company was destroyed by fire; loss, $40,000.

A machine shop, to cost about $10,000, is being erected for Braudy & Sons, Grand Rapids, Mich.

The Chicago City Railway Company is having plans prepared for a power-house, to cost about $5,000,000.

The National Compressed Coal Company, Sioux City, Ia., has let contracts for the erection of a plant.

It is announced that the Carisso (Wyo.) Gold Mining Company will erect an $80,000 electric power plant.

The Adolphus Busch Glass Works, St. Louis, Mo., were destroyed by fire recently, entailing a loss of $75,000.

The Niagara Falls Electrical Transmission Company, of Niagara Falls, N. Y., has been incorporated; capital, $50,000.

The Western Caske. Manufacturing Company has been organized and will erect a $25,000 factory in Denver, Colo.

It is reported that the Chicago & Northwestern Railroad Company will erect large repair shops at Green Bay, Wis.

Work on a $75,000 bleachery at Barrowsville, Mass., will soon begin. Lewis J. Pierce, of Providence, is the contractor.

Swift & Co. have about completed plans for the establishment of a glue factory, a wool pullery and a hair factory in St. Joseph, Mo.

The Chamber of Commerce of El Paso, Tex., has received assurances that a glass factory will be established there.

The Cincinnati, New Orleans & Texas Pacific Railroad will erect shops at Somerset, Ky., at a cost of about $500,000.

The Columbia Nut & Bolt Company, Bridgeport, Conn., will erect a new factory, increasing the capacity of its output.

Schwender Bros. have established The Novelty Works at Mankato, Minn., and will make a specialty of gasoline engines.

It is reported that the Erie Railroad Company will enlarge its shops at Hornellsville, N. Y., at an expenditure of $150,000.

The Teoloyucan Brick Company will double the capacity of its output at Teoloyucan, a short distance from Mexico City, Mex.

The Williams-Abbott Company, of Cleveland, which manufactures telephone supplies, will establish a branch factory at Cadiz, O.

A factory for I. S. Remsen, of Brooklyn, N. Y., is being erected at Rockville Center, N. Y., for the manufacture of cement stone.

The Mutual Electric & Machine Company, Wheeling, W. Va., will erect a factory for the manufacture of special electrical apparatus.

The Crawford-Speer Foundry & Machine Company's plant at Bridgewater, Pa., was destroyed by fire, entailing a loss of $9,000.

The Denver (Colo.) Pressed Brick Company, whose plant was destroyed by fire recently, is rebuilding at an outlay of $40,000.

The Garland Manufacturing Company, Saco, Me., loom pickers, etc., will enlarge its plant, putting in new boilers and a large engine.

Plans have been received from the architect for the brewery to be erected by the Consumers' Brewing Company, at Ashtabula, Ohio.

The saw and heading building of the East Jordan (Mich.) Cooperage Company was burned recently; loss, $10,000. It will be rebuilt.

The Frazer & Jones Company, Syracuse, N. Y., will enlarge its factory by erecting a new building for foundry and pattern purposes.

Jos. Dresen, of Prairie du Sac, Wis., will locate in Wales, Wis., and establish a shop for manufacturing all kinds of building material.

It is reported that Mrs. Lydia Bradley, of Peoria, Ill., and founder of the Bradley Institute, will erect a filler plant at or near Manito.

It is reported that a large glass bottle factory will be erected in Houston, Tex. Major D. F. Allen, of Frankfort, Ind., is interested.

The Albany (Ga.) Power & Manufacturing Company is constructing a dam and power-house at Big Shoals, Ga., at a cost of over $100,000.

Charter has been filed for a cotton factory in Acworth, Ga. Orlando Awtrey, of Acworth, is president of the temporary board of directors.

The American Textile Company, Cartersville, Ga., which has just erected a mill there, contemplates doubling this during the next twelve months.

The Jonson Bros., of Rockford, Ill., have incorporated as the Rockford Wood Finishing Company, and will erect a manufactory and warehouse.

The York (Pa.) Manufacturing Company will erect a pattern-house shortly and later on increase the capacity for the manufacture of sheet-iron cans.

The Fort Wayne (Ind.) & Wabash Valley Traction Company will issue bonds and with the proceeds build a central power plant and buy new equipment.

John R. Wiggins & Co., Philadelphia, Pa., have asked for estimates upon plans for alterations to the engine- and boiler-house for Geo. W. Smith & Co.

The Chamber of Commerce of El Paso, Tex., is negotiating for the establishment of a French silk factory, which will employ 1,000 men at the start, it is said.

The Minster (O.) Machine Company has been bought by Wapakoneta capitalists, and the shops will be removed to the latter city. A new factory will be erected.

The Williams Bros. Manufacturing Company, Glastonbury, Conn., table cutlery, etc., will build an addition to its factory to be used as a burnishing department.

The Koochiching Power Company, which is about to develop the water power at International Falls, Minn., is making preparations to begin work early in the spring.

A loss of $100,000 was caused by a fire that originated in a factory building of the Winnepesaukee Lake Cotton & Woolen Manufacturing Company at Laconia, N. H.

The Whitney & Sloo Company, Ltd., New Orleans, La., is putting up a factory for the manufacture of goods used in its business, which is saddles, harness, collars, etc.

The Nelson Manufacturing Company, Quincy, Mass., recently incorporated, will erect a factory for the manufacture of ball cocks, tanks and other plumbing supplies.

P. L. Kimberly and J. V. Rose, of Sharon, Pa., are interested in a $150,000 plant now being erected in East Oakland, Cal., for the manufacture of magnesite bricks and tile.

The Penn Bridge Company, whose plant at Beaver Falls, Pa., was recently destroyed by fire, has leased a plant at Carnegie, which will be used until new buildings are erected.

The T. & S. C. White Company, sulfur refiner, at Old Hook Road, Constable Hook, Bayonne, N. J., will erect a new building, to be equipped with all the latest factory devices.

C. M. Sandoval, of C. M. Sandoval & Co., of St. Louis, Mo., has organized a company under the name of the Mexican Brick Evolution Company, Ltd., to manufacture bricks in Mexico.

"The Pastime," No. 9 South Main street, Memphis, Tenn., will install an electric lighting plant, and is in the market for a 35- to 50-kilowatt generator, driven by a gas or gasoline engine.

A company with a capital of $250,000 is being organized to operate a rubber factory in Norwood, O. W. G. Brown, formerly manager of the Cleveland Rubber Company, will manage the new plant.

Plans have been prepared for a two-story power-house and laundry at the Home for the Aged, at Lawrenceville, N. J. The contract for erection will shortly be awarded by Bishop McFaul, president of the Board of Trustees.

City Engineer Rust, of Toronto, Ont., as the result of an investigation, will recommend that the city install four centrifugal pumps in connection with the proposed high-pressure fire system. Two of these will be run by electric motors and two by steam turbines.

New Catalogs.

Hopkinson Machine Works, Springfield, Mass. Circular and price list of the Hopkinson drill vise. Illustrated.

Roscoe W. Ney, Kingston, N. Y. Circular containing price list and data of the Ney precision disk grinders. Illustrated.

The Fosdick Machine Tool Company, Cincinnati, O. Circular illustrating and describing 5-foot arm standard radial drill.

Newton Machine Tool Works, Inc., Philadelphia, Pa. Catalog No. 40, describing vertical milling machines. Illustrated. 6x9, pp. 15, paper.

Colburn Machine Tool Company, Franklin, Pa. Bulletin No. 17, supplementing Catalog "A" of universal saw table. Illustrated. 6x9, pp. 4, paper.

The Burke Machine Company, 5 Power street, Cleveland, O. Circular describing No. 1 and No. 2 bench miller and No. 1 coal oil shop forge. Illustrated. 5x7½, pp. 4, paper.

Hyatt Roller Bearing Company, Harrison, N. J. Bulletin No. 117, giving dimensions, capacities and price list of standard roller car bearings for shop cars, trucks, cranes, trolleys, etc. Illustrated. 7x9, pp. 9, paper.

Pawling & Harnischfeger, Milwaukee, Wis. Bulletin No. 16, January, 1905. This contains very fine half-tone engravings illustrating twelve different types of hoists; also contains a partial list of users. 7½x11, pp. 24, paper.

We have received from Vandyck Churchill Company, 8 Dey street, New York, catalog describing the Higley metal sawing machines and saw grinders. This contains very fine half-tone illustrations, also testimonials and list of users. 6x9, pp. 47, paper.

Clayton Air Compressor Works, 114 Liberty street, New York. Bulletin C202, "Compressed Facts About Compressed Air," giving a resume of the points to be considered in buying an air compressor of medium capacity. Illustrated. 3½x6, pp. 32, paper.

Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. Circular No. 1097, describing type "K" motors. Illustrated. 7x10, pp. 31, paper; also circular No. 1099, illustrating and describing type "R" motor for direct-current circuits. 7x10, pp. 8, paper.

Ingersoll-Sergeant Drill Company, 26 Cortlandt street, New York. Pamphlet, Form 35A, summing up in a few words the important facts concerning the different types of air compressors and other products supplied by this company. Illustrated. 3¼x5½, pp. 14, paper.

Copies of the new (1905) edition of the Brown & Sharpe Manufacturing Company's catalog have reached this office, containing considerable additional matter of interest, besides the tabular and other information of value to all who work in machine shops; this feature being the more commendable for the fact that the catalog is sent free, postage paid, to any address.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Light drop forgings to order in quantities. Remington Arms Company, Ilion, N. Y.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Any manufacturer desiring to build gas engines address Box 386, AMER. MACHINIST.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Screw machine work to order up to ⅞ in., in quantities. Remington Arms Company, Ilion, N. Y.

Machines practically designed; drawings and tracings. R. Sheldon Strahan, Box 167, Brooklyn, N. Y.

Salesman of machinery supplies to handle "Lang's T-bolt heads" on commission. G. R. Lang Co., Cincinnati, O.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

"The Mechanical World Pocket Diary for Machinists and Draftsmen," 1905 edition, price 75c. Address James Saunders, New Castle, Del.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, grav, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

Factory Accommodation for Rent.—American manufacturers desiring to open manufacturing branches in Canada can secure accommodation from the undersigned. Steam heat, electric light and power, natural gas, railway switches at door. Abundant labor. Write for particulars. State what you want. The Mill Properties Company, Limited, Dundas, Canada.

Mechanical engineer, with established suite of offices, centrally located, Chicago, desires to establish Western branch, with Chicago headquarters, for Eastern house with established reputation in machinery, tools, transmission or specialty of approved merits, requiring high-grade, successful pusher; 20 years' experience in mechanical line. Address Will Doit, 221 Belle Plaine, Chicago.

Business Opportunities.

Large foundry and machine company in Missouri has complete patterns and equipment for manufacturing several high-grade machines. Party with $5,000 can secure a highly paying interest in this business. Address Box 389, AMERICAN MACHINIST.

Correspondence invited from manufacturing concerns wishing to establish a supply depot and agency for the Ohio Valley and Middle West. Business connection is sought by party who is thoroughly practical in manufacturing lines, and who has had 10 years' experience as business manager and salesman. Commodious offices and elegantly lighted show and ware rooms (40x100 ft.) at Dayton, O., will be furnished. References exchanged. Business connection with large houses only will be considered. Address "Business Manager," Lock Box 397, Dayton, Ohio.

For Sale.

For Sale—Long-established machine shop in this thriving city; cause of sale, death in firm. W. D. Judson, New Haven, Conn.

Shafting straighteners, 1¼ to 5 in.; also horizontal cast column disc sander and rolls for flattening wire; both cheap. J. H. Wells, Tampa, Fla.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Draftsman, with 4 years' first-class experience, wishes position in or near New York. Box 366, AMERICAN MACHINIST.

Position as superintendent, by up-to-date, all-round American mechanic; 15 years' experience as superintendent; well up in time and cost-keeping and cost-reducing systems. Box 380, AMERICAN MACHINIST.

ILLINOIS.

Permanent position, by quick estimator and competent designer of inventive and executive ability; traveling cranes, elevators and general hoisting machinery; qualified to start concern in these branches; references; location immaterial; technical education. Box 273, AMERICAN MACHINIST.

INDIANA.

Mechanical engineer and technical graduate (age 26) wants position as engineer, assistant engineer or superintendent, after April 1st; inquiries solicited stating particulars. Box 368, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical engineer, technical graduate, 7 years' experience, 4 of which with leading electric company, in motor equipment of shops, mills and factories, wants position in New England or New York. Box 381, AM. M.

NEW JERSEY.

Toolroom foreman, thorough mechanic, desires change; A1 references. Box 353, A. M.

Mechanical and electrical engineer wants position; 8 years' experience, shop and drafting room. Box 347, AMERICAN MACHINIST.

Draftsman, machinist, with technical education, desires position as shop draftsman and assistant to superintendent; 4½ years' varied drafting experience; age 26; location anywhere; first-class references. Box 376, AMERICAN MACHINIST.

Position as superintendent or general foreman, by an up-to-date American; 15 years' practical experience on steam and gas engines, pumps, air compressors, hoisting machinery, etc.; understands cost-reducing and cost-keeping systems; married; age 36; best references. Box 355, AMERICAN MACHINIST.

NEW YORK.

Mechanical engineer; thorough on gas engine construction. Box 362, AMER. MACH.

Mechanical draftsman, young man, desires position; salary $15. Box 363, AM. MACH.

Mechanical draftsman, age 24, wishes position; salary expected, $21. Box 360, AM. M.

Draftsman, experienced on general and special machinery. Box 383, AMER. MACHINIST.

By excellent draftsman, 35, quick worker, from 8 to 12 A. M., in or around city (teaching afternoons). Box 367, AMER. MACH.

Mechanical and electrical engineer, university graduate, with 2 years' experience, wishes position as draftsman. Box 375, A. M.

Mechanical superintendent open for position; first class in every particular; well acquainted with explosive engines. Box 393, AMERICAN MACHINIST.

High-grade mechanical draftsman, college graduate, 12 years' experience, aged 32, married, capable of taking charge, desires position. Box 390, AMERICAN MACHINIST.

Mechanical draftsman, first-class designer of dies, fixtures, automatic tools, etc.; 6 years' shop and drawing-room experience, good references, wishes position. Box 385, AMERICAN MACHINIST.

Brass moulder wants position; 20 years' experience on general jobbing, heavy or light; willing to go to any part of United States or Canada; sober and industrious. Address Box 364, AMERICAN MACHINIST.

Mechanical engineer (35) desires position with a manufacturing concern; 10 years' experience in machine construction, power plant and mill design; competent to handle men and supervise work. Box 384, AM. M.

Up-to-date superintendent; can show results in stated time; "knows how" to get good work out cheap; work all help to four decimals; will subcontract your labor; tool designer; at liberty April 1. Box 382, A. M.

I have experience as designer, patentee and manufacturing, typewriters, typewriter adding machines, adding machines and automatic machinery; want situation as superintendent or draftsman and designer. Address Box 359, AMERICAN MACHINIST.

Draftsman and designer, specialty machine tools, jigs and fixtures for duplicate work, 1- years' shop and 2 years' drawing-room experience in Germany, also 1 year American shop experience, wishes position in New York, Connecticut or Massachusetts. Box 358, A.

Position wanted by first-class machinery salesman, graduate of European college; has been engaged the past 10 years selling to the trade and consumers, machinery, tools and supplies in Europe; would prefer to represent an American house in Germany, Russia or any part of Europe; conversant with English, German, Russian and French languages; good correspondent and thorough expert in his line. Address Box 340, AMER. MACH.

Superintendent of manufacturing or master mechanic, by an expert mechanic of 20 years' experience; a broad-gauge man, possessing executive ability and thoroughly familiar with the most approved processes for the manufacturing of interchangeable work

The Layout and Construction of Cams—I.

BY CHARLES F. SMITH.

CLASSIFICATION OF CAMS.

In any discussion of cams we must distinguish two kinds. The first is that in which the only requirement is that the operating point shall move a given distance, the movement beginning and ending at certain points in the revolution of the cam shaft. The second is that in which there is an additional requirement that the operating point shall at all times during its movement occupy predetermined positions. The first kind is much the more numerous and its discussion will form the chief subject of these articles, tho the methods of laying out the second kind will also be shown. It will be noted that when laying out the first kind we are at full liberty to lay out the cam groove with a view to avoiding abruptness of movement, whereas, with the second kind, those movements being prescribed, we have much less liberty in this respect. It might be imagined at first thought that we have no such liberty, but this is not so, since with this, as with the first variety, more favorable angles of the cam groove may be obtained by increasing the diameter of the cam.

ORDER OF WORK WHEN LAYING OUT AUTOMATIC MACHINES.

The starting point when designing any piece of automatic machinery is the work to be done. The piece to be operated upon is to be put thru certain processes involving movements of the piece itself and of the chucking devices and other tools which operate upon it and the sequence of these movements must first be worked out. My own procedure is to first design the end of the machine which operates upon the piece to be manipulated, deciding upon the operations to be performed and the movements to be made, and from this to work backward to the cams which are to give these movements and then to build the frame around the mechanism so designed. Of course, in this kind of work, like all others, the element of cut and try enters, and developments during the later stages of the process often make it necessary to retrace one's steps, but, broadly speaking, the order of work is as described:

1. Determine the sequence and character of the movements at the point where the work is to be done.

2. Determine the location and form of the cams necessary to give those movements.

3. Fill in the frame around this mechanism.

ORDER OF WORK FOR LAYING OUT AND MAKING CAMS.

In the matter of cam layout and construction, I have, as the result of many years' experience, developed a regular line of procedure which follows the determination of the movements given in (1) above, and is as follows:

1. The movements are charted full size upon a single sheet, the base line of

FIG. 1. THE CHAIN TO BE MADE.

which represents the development of the entire circumference of the cam surfaces. Verticals are drawn from the base line dividing the circumference into parts of equal width, the divisions usually representing five degrees, tho their number may be increased in the case of very particular work. The left hand vertical is divided into parts of an inch and on these lines the movements are laid out, a line, which is parallel to the base line except where the movements occur, being drawn for each cam and its length being such as to represent the entire circumference. The rising and falling of each line with respect to the base line represents the movement of its cam roller in the cam groove. In laying out this chart we have given the already decided upon movements which locate the beginning and ending of the roller movements and by connecting these points by inclined lines we get a picture of all the movements. These inclined lines will lie at various angles to the base line and at this point the first determination of the cam dimensions is made. To avoid undue abruptness of movement this angle should not exceed thirty degrees. Should the steepest angle exceed this figure it is necessary to redraw the chart with such an increased circumference as will reduce the angle to this figure.

The diameter of the cam having this steepest angle being thus determined, this diameter is then preferably made the diameter of all the others, the result being that thirty degrees becomes the most unfavorable angle of the set of cams, all but one having, usually, a less angle than this. Making the cams of a single diameter also greatly facilitates their laying out in detail.

2. The movements being charted the next step is the drawing of the cams and the laying out of their grooves, the grooves being so shaped as to give an easy start and stop to the piece, and for this I use a uniform method which gives a movement equivalent to that produced upon a cross head by the half turn of a crank having a Scotch yoke connection, and this movement is always secured at the operating point regardless of the disturbing influence of connecting rods, bell cranks, etc.

3. The cam profile as thus determined is transferred to a piece of thin sheet zink tacked over the drawing and then removed and carefully dressed to the required form by hand, thus forming a templet of the outline of the cam.

4. The templet is placed upon the blank which is to become the former for the milling machine and is scribed around with a fine, sharp scriber, thus transferring the outline to the former.

5. The former is then dressed to the outline thus obtained, and

6. The former and cam blank are placed in a suitable milling machine and the cam groove is milled.

POSITIVE MOTION VS. SPRING RETURN CAMS.

All of these steps will be fully described and illustrated in what follows. One important point in all cam work is to have

the cam shaft of ample size to do its work without vibration, as thereby the life of the cams is greatly increased. In my own work I avoid the use of springs for the return movement and ordinarily make the cam perform this movement positively. In some classes of work, notably paper handling in which the material must be coaxed rather than driven, the use of springs is sometimes necessary to perform the *operating* movement, the return being effected by the cam, but in all ordinary metal-working machinery I make the cam perform both movements. Not only does this result in positive and correct movements regardless of speed, but it relieves the cams and rollers of unnecessary labor. When springs are used they must be strong enough to effect the movement with some surplus and the effort of extending or compressing the springs is added to the effort necessary to do the work, thus in many cases more than doubling the pressure on the rollers. A notable instance of the use of springs is found in the linotype, in which the springs perform the actuating movements, the cams merely returning the parts to the idle positions. Of course, when springs are used the form of the cam surface down which the roller runs while the spring is doing its work has to be determined with the same care as when the movement is positive, the difference being that with the spring the roller merely rides on the cam under spring pressure, while without it the roller is embraced by the cam groove. Except that the milling cutter must be kept to size, there is no greater difficulty in making a cam to give a positive return than in making one to be used with a spring.

A CAM OPERATED MACHINE.

Fig. 1 illustrates full size a new chain which was invented and patented by another party and then brought to me with a commission to design a machine for making it. The resulting machine, made by the Garvin Machine Company, is shown in Figs. 2 and 3. It contains sixteen cams and the sufficiency of the methods to be given is shown by the fact that the cams were laid out and constructed, including key-seating, by these methods and when assembled they performed their work perfectly. Other parts of the machine required slight doctoring, as is expected in such work, but, except for dressing off the burrs, there was not given to the cams so much as the touch of a file after they left the milling machines. While the design of the machine as a whole cannot be given, some of its cams will be taken as examples of the methods used.

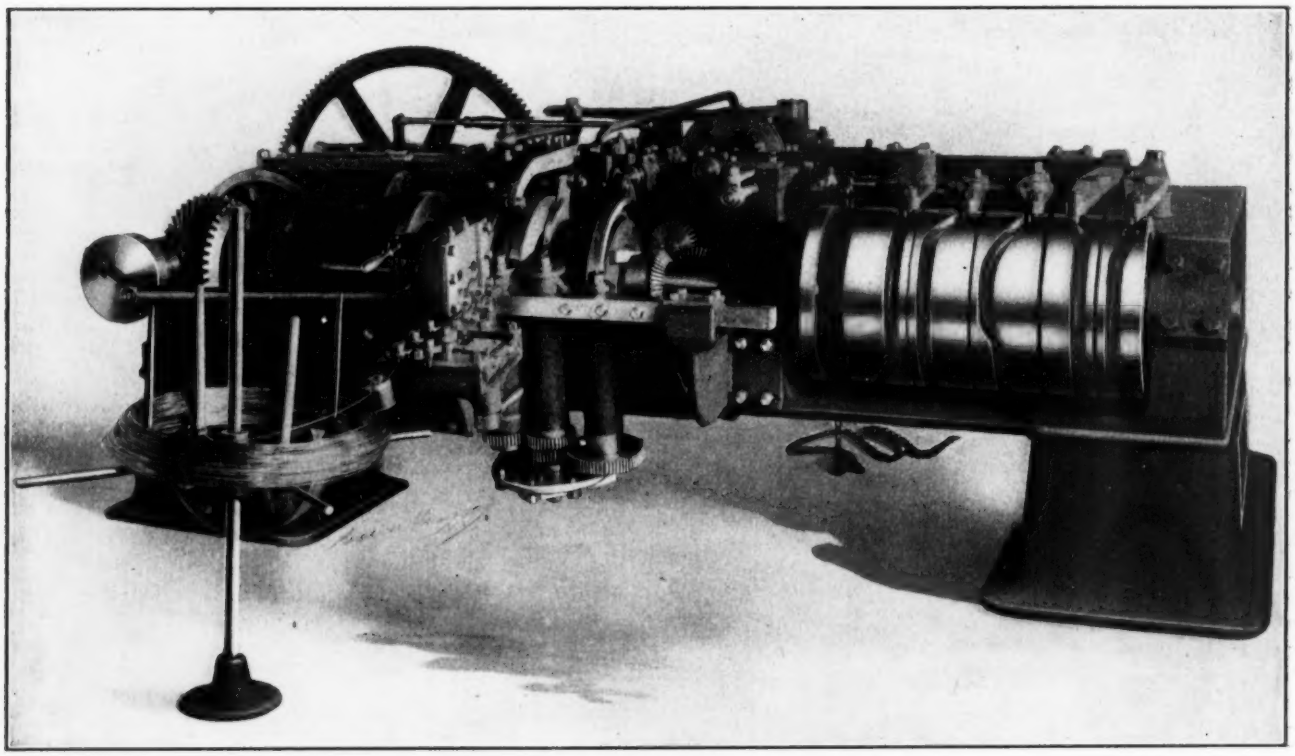


FIG. 2. CHAIN MAKING MACHINE. FRONT VIEW.

LAYING OUT A SINGLE CAM.

While the charting of the movements is the first step in laying out a set of cams, it is desirable, in order to avoid a break in the description of the process of laying out the drawings and making the templets and formers, to here first take up the method of laying out a single cam groove without regard to its mates, in order to give an easy start and stop to the movements.

Fig. 4 shows the simplest possible case, that of a perifery cam similar to those shown in the immediate foreground of Fig. 2, except that the roller is supposed to be mounted on a slide and thus to move in a straight line parallel with the shaft, instead of being mounted on an arm and thus move in the arc of a circle, as in Fig. 2. The rectangle o, *B*, *C*, 12 represents the development of that part of the cam's perifery in which the movement is to take place. The movement of the roller is shown full size by the line o *B*, and this movement is to be performed while the cam turns thru an arc of which *B C* is the development. Upon *A* o equal and parallel to *B* o, a semicircle, called the throw-circle, is drawn equal in diameter to the movement of the roller and this semicircle is divided into any number of equal parts—in this case 12. The developed arc *B C* is then divided into the same number of equal parts and projection lines from the points on the semicircle give by their intersections with the corresponding verticals points on the center line of the cam groove as indicated by the small circles. In the present case the resulting curve is the projection of a true helix. It will be observed that while the cam turns from *B* to *C* the movement of the roller is precisely the same as would be given by a crank turning thru the semicircle o, 6, 12. The return movement may or may not be performed in the same interval of time, but its groove will be laid out in the same way. Should the movements be performed in the same time the move-

ment of the roller is precisely the same as that of a cross head, but with a pause at each end of the stroke, and should they be performed in different times the same will be true except that one movement will be made more quickly than the other.

THE LIMITING ANGLE.

The limiting angle of 30 degrees is that of the tangent to the middle of the center line of the groove as indicated in the figure. In laying out the drawing the distances o *B* and *B C* are given as has been stated, and it is desirable in the preliminary work to avoid the necessity of laying out the curve in order to determine this angle, as this might involve tedious repetition, and this determination may be made in several ways. Thus with the angle equal to 30 degrees there is a constant ratio of 2.72 between the length of the lines *B* o and *B C*. *B* o being given by the conditions of the problem, it is only necessary to multiply it by 2.72 in order to obtain the length which *B C* must have in order to make the final angle 30 degrees. Of course, the length of *B C* considered as a fraction of the entire circumference is also known and from this the entire circumference and the diameter of the cam may be quickly determined. Thus, *B C* being 2.72 times the throw and occupying say *n* degrees of the circumference, we have:

$$\text{Circumference} = 2.72 \times \text{throw} \times \frac{360}{n}$$

$$\text{or diameter} = \frac{2.72 \times \text{throw} \times 360}{3.1416 \times n}$$

$$= \frac{312 \times \text{throw}}{n}, \text{ approximately.}$$

That is the greatest throw of the set of cams in inches multiplied by 312 and divided by the number of degrees of the cam's circumference occupied by the movement gives the diameter of the cam in inches. If a protractor is at hand the length of *B C* may also be determined by the fact that with the angle of the tangent equal to 30 degrees the angle *C* o 12 will be equal to 20 degrees 12 minutes or, for practical purposes, 20 degrees. This ratio of 2.72, and this angle of 20 degrees, are strictly correct for perifery cams, of which the rollers move in straight lines only, but they may be used for cams of which the rollers are guided by radius arms without appreciable error. For face cams these constants may be modified, as will be explained later. It will be observed also that near the point of tangency the curve and tangent coincide very closely and we may take advantage of this to obtain a graphical method which is accurate enough and which I constantly use. Having divided the end circle, I lay out the triangle *a b c*, the hight being projected from the stroke circle and the hypothenuse being drawn at 30 degrees, when the base gives the length of one of the divisions of the base line. The same result may, of course, be obtained from the triangle *c d e*. The chief use of the constants is in the preliminary layout of the chart, as will be explained later. When laying out the curves on the individual cam drawings I always use the graphical method last described.

PERIFERY CAMS WITH RADIUS ARMS.

If the roller is supported, as it usually is, by a radius arm the procedure is slightly modified as shown in Fig. 5. The base line and throw circle are divided as before, but instead of drawing perpendiculars from the base line divisions, arcs of circles are struck thru them with a radius equal to that of the proposed radius arm, as indicated by the line *a b* and centers *c d e*, etc., and the intersections of these arcs with the projection lines from the divisions of the throw circle form the locating points for the center line of the cam groove as indicated by the small circles. The angle of this line at its middle should, as in the former case, be not greater than 30 degrees, as shown, and is predetermined as in Fig. 4.

OBJECTIONABLE FORMS OF CAMS.

Figs. 6 and 7 show very objectionable forms of cam grooves, Fig. 6 being for a roller mounted on a slide, and Fig. 7 for one carried by a radius arm. There is here no gradual starting and stopping, the motion being uniform throughout and of course started and stopped abruptly, and therefore with a shock. Similar forms are often seen, though usually with rounded curves drawn in by the eye or from arbitrary centers at the beginning and ending of the incline. The ease with which a crank motion curve may be laid out should lead to its regular use.

FACE CAMS.

The two diagrams shown cover practically all cases of cams of which the grooves are upon the perifery. When the groove is upon the side or face of the cam disk the procedure is shown in Figs. 8 and 9. Fig. 8 corresponds with Fig. 4 in that the roller is mounted upon a slide which moves radially with the cam

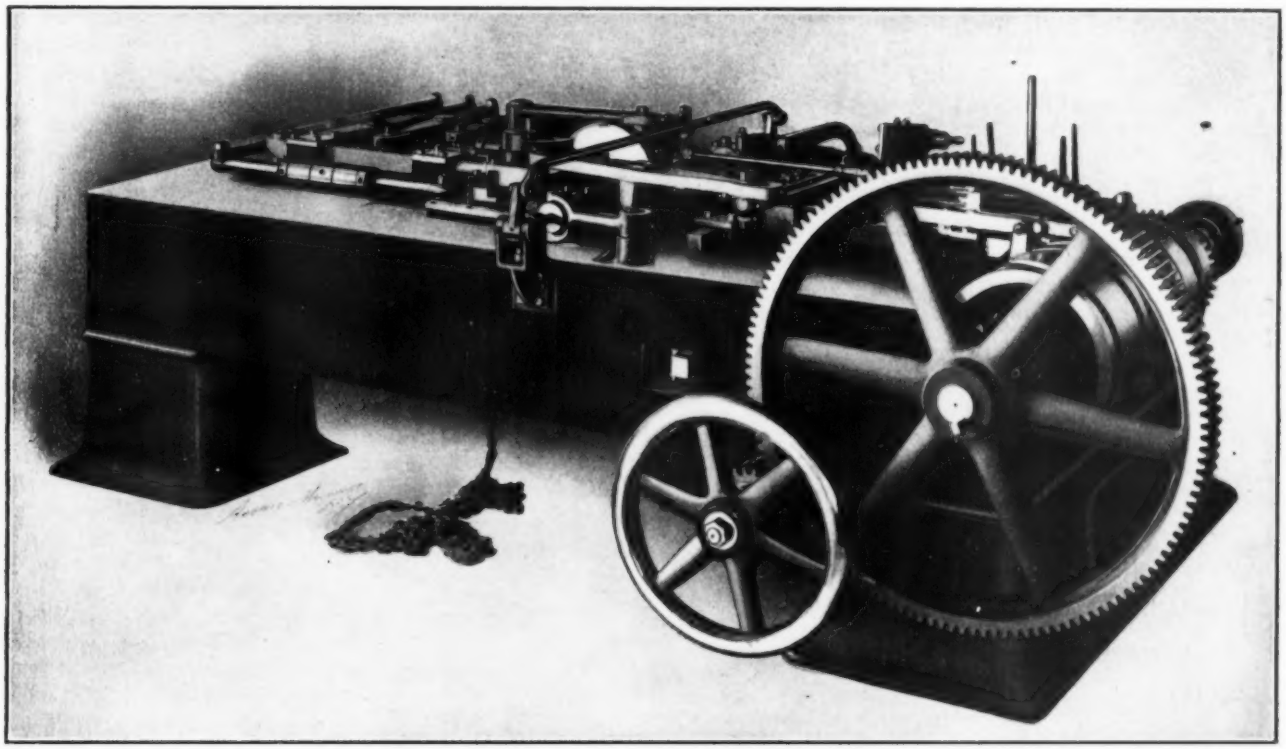


FIG. 3. CHAIN MAKING MACHINE. REAR VIEW.

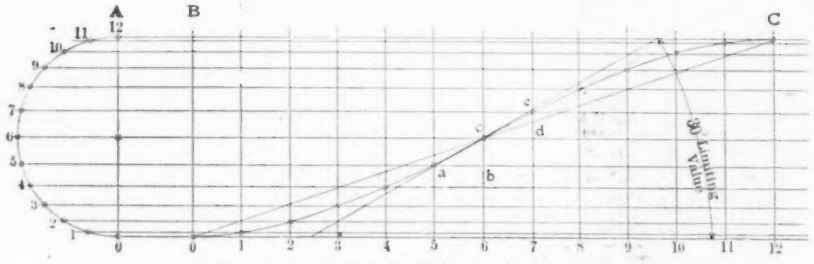


FIG. 4 Periphery Cam. Crank Motion, for Operating a Slide

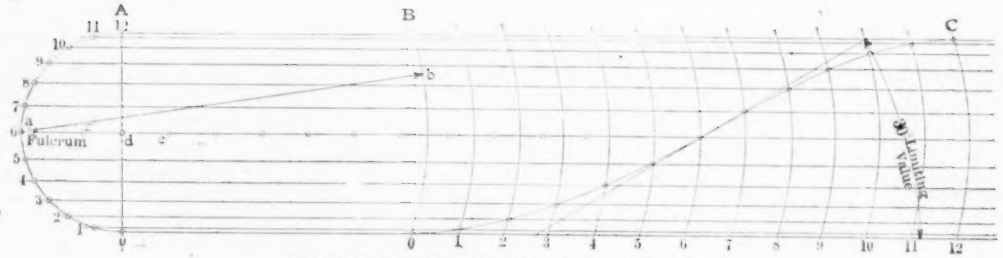


FIG. 5 Periphery Cam, Crank Motion, for Operating a Pivoted Lever

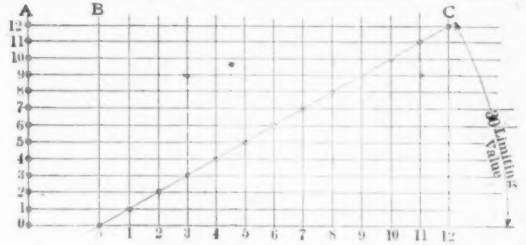


FIG. 6 Periphery Cam. Uniform Motion, for Operating a Slide

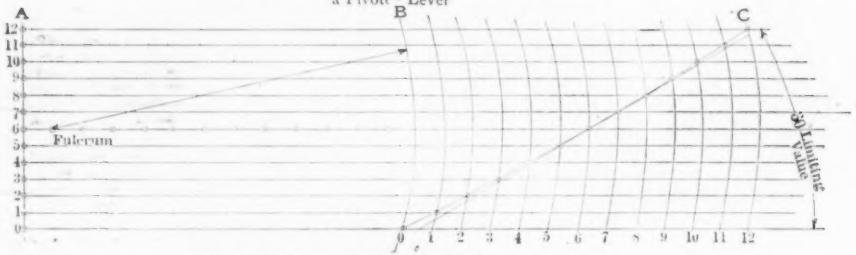


FIG. 7 Periphery Cam. Uniform Motion, for Operating a Pivoted Lever

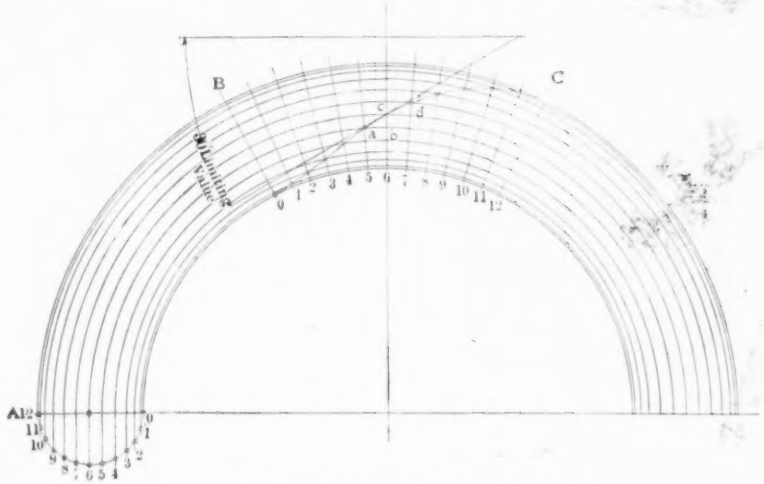


FIG. 8 Face Cam. Crank Motion, for Operating a Slide

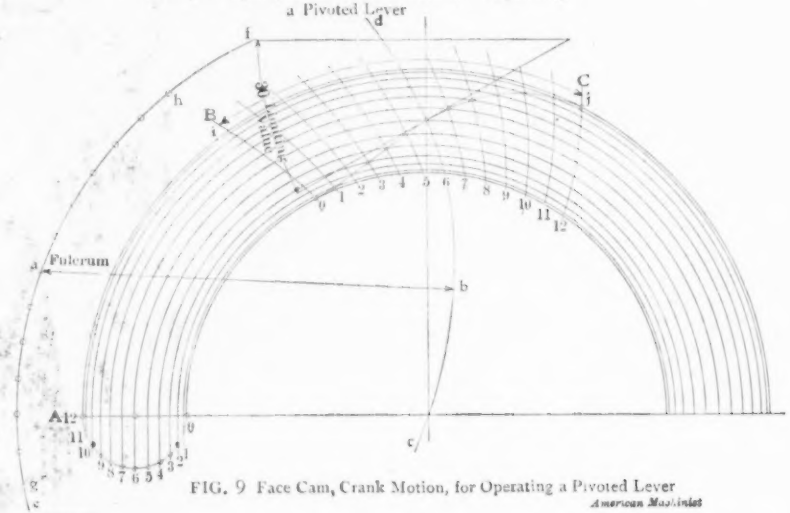


FIG. 9 Face Cam, Crank Motion, for Operating a Pivoted Lever

American Machinist

THE LAYOUT OF CAM GROOVES.

disk. The cam is here required to move the roller the distance oB while turning thru the angle $B\ C$. The throw circle 0, 6, 12 is drawn with a diameter equal to the radial movement of the roller and is divided as before into equal parts. The cam angle is similarly divided and radius lines 0, 1, 2, 3, etc., are drawn. The division points of the circle are projected to its diameter and arcs struck from the center of the disk and from the feet of the projection lines give by their intersection with the radial lines the points of the center line of the cam groove; the limiting angle appearing as before. In determining this angle for this style of cam the lower triangle $a\ b\ c$ should be used in preference to the upper one $c\ d\ e$, as the tangency is closer below the middle point than above it. As with the perifery cam this angle is regulated by varying the diameter of the cam disk.

In laying down this style of cam upon the chart the figure B, 0, 12, C must, of course, be represented by a rectangle of which the length is properly made equal to the outer arc $B\ C$. The constants which have been given for perifery cams become for this construction 3.23 and 17 degrees 15 minutes, or, for practical purposes, 17 degrees; that is, the length of the rectangle should be at least 3.23 times its hight and the angle of its diagonal with its base should not exceed 17 degrees, showing that face cams must be larger than the perifery style in order to have an equally favorable angle and hence I prefer the latter.

While the constants given above apply to face cams, the extreme radius of a face cam groove is not much less than the radius of the piece, there being but a wall of metal and the radius of the roller between, and the convenience of a uniform outside diameter of cams is so great that I usually neglect it and lay out all the curves of a chart as tho the cams were all to be of the perifery style and then make both face and perifery cams of the same outside diameter. The face cam grooves will thus be slightly steeper than if they were of the perifery style, but in only a few, and probably in no, case will the angle extend 30 degrees. Were this angle to be materially exceeded in one of the face cams, especially in an important one doing heavy work, I would redesign and enlarge the whole set.

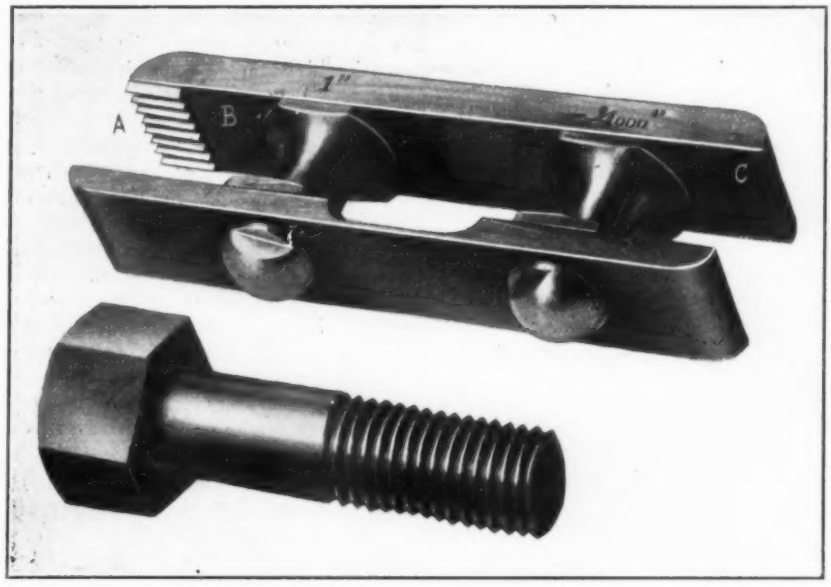


FIG. 1. THREAD TEST GAGE.

In Fig. 9 the roller is carried by a radius arm of a length $a\ b$. An arc $c\ d$ is so struck as to pass thru the center of the cam shaft if possible. Sometimes this is impossible, but the practise should be departed from only in case of necessity. The center a located, the arc $e\ f$ is struck from the center of the cam disk and from centers located on it and with a radius equal to the length of the arm the arcs B, 0 and C, 12 are struck, such that the arc $i\ j$ is the angle of cam movement during which the roller movement is to take place. The arc $e\ f$ between the extreme centers $g\ h$ of the arcs $B\,0$ and $C\,12$ is then divided as in previous cases and arcs 0, 1, 2, 3, etc., are drawn from the division points as centers. The throw circle 0, 6, 12 is then drawn and the cam curve is quickly located. The limiting angle is again shown.

A Thread-Testing Gage.

BY DR. ALFRED GRADENWITZ.

A very efficient thread-testing gage has recently been patented by the Dresdner Bohrmaschinen fabrik A. G., formerly Bernhard Fischer & Winsch, of Dresden, Germany. The handling of this new device is simple and easily learned. Screws can be tested by it not only with any degree of accuracy, but the external diameter, diameter at root of thread, pitch, and form of thread may also be ascertained.

The testing gage, Fig. 1, comprises two hardened and ground members, parallel to one another, solidly connected by cross pieces having large contact surfaces and screws. In one of the members A the shape and depth of the thread has been accurately worked, while the adjoining surface B corresponds to the external diameter. On the opposite end of the gage both legs are smooth, spaced apart the minimum width admissible for the external diameter of the screw. These sizes are indicated on the gage for each size.

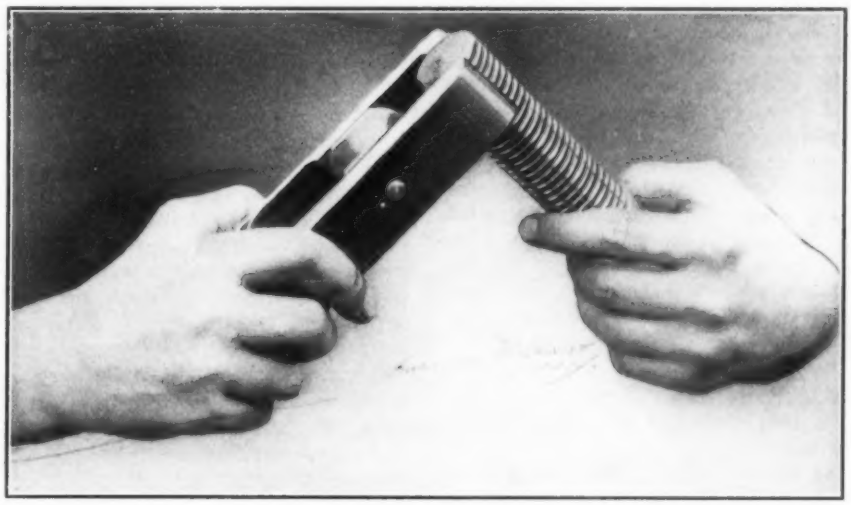


FIG. 2. TEST GAGE IN USE.

The gage is used as follows. One first tries to introduce the screw between the two smooth terminal surfaces C of the legs; if it enters, the external diameter is too small, so that the screw being unavailable need not be further tested. If, however, the screw does not enter, the test is continued on the opposite end. The screw should readily fit into the gage A, Fig. 2. On entering the point of the screw it is ascertained whether the pitch and shape of the thread are correct. If

the screw can be introduced at *B* from the side and does not fit in *A* from the front, its external diameter is correct, but the pitch is not. Screws having threads that are stretched or otherwise deformed do not pass thru *A*.

Equipment and Work of Metallographical Laboratories in Germany.

BY E. P. BUFFET.

A recent writer in the AMERICAN MACHINIST spoke slightingly of metallography for ascertaining the practical qualities of materials. Competent engineers in Germany are still regarding it with a good deal of favor, as is proved by the standing of more than one laboratory newly equipped to carry on this line of study.

There have recently come to hand articles in two leading German engineering periodicals describing new metallographical plants. One has to do with the equipment of the magnificent Royal Material-Testing Laboratories at Gross-Lichterfelde West, connected with the Berlin Technical High School. It has attracted considerable attention in the empire and is said to be already the subject of a whole book. The present description is extracted from the *Zeitshrift* of the Association of German Engineers. The other laboratory, which has been described by A. Schueller in *Stahl und Eisen*, is that of the Ironmakers' Institute of the Royal Technical High School at Aix-la-Chapelle.

To the field of work of the first-named institution belong:

(1) Determination of the structural differences in metals and alloys; etching experiments as bases for choosing test specimens at different parts of the cross-section and for taking samples for analysis; zone formation in gray iron; influence of the same on properties of strength; determination of flaws, cracks, cinder-nests, separations by liquation, cavities, imperfect welds in the material; determination of the proportion of red oxide of copper and the manner in which it is contained in copper.

(2) Determination of welding places; difference of seamless, welded, and brazed tubes, etc.

(3) Determination of material—wrought iron, gray iron, cast steel, case-hardened metal, etc.

(4) Determination of the treatment the metal has received—indications of permanent changes of shape produced by heating in air and the form of these changes; effect of drilling or punching holes in gray iron on the surroundings of the hole; effect of bringing to a bright heat and overheating; determining whether carbon steel is hardened and tempered; approximate degree of heat at which hardening results; whether hardened after overheating or at normal heat; hardening cracks; determination of the cross and longitudinal direction in fragments or test pieces from forged or rolled material; "hydrogen-brittleness" of copper and iron.

(5) Determination of the melting point as well as the beginning and end of fusion of metals and alloys; influence of the composition on the position of this point; determination of the points of regression in iron alloys and their influence on the treatment of the alloys.

(6) Comparative investigations of the effects of water and corroding liquids on metals and alloys.

(7) Systematic investigation of series of alloys as regards inner structure, properties of strength, working qualities (fusibility, malleability, ability to be rolled and to be machined, etc.); change of working qualities by treatment of the material.

(8) Systematic series of experiments as to the influence of foreign elements associated with metals and alloys on their working qualities.

(9) Explanation of sporadic phenomena which enter in practise when producing and working metals and alloys.

(10) Extension of the metallographical process to aid in tests of materials.

The technical high school at Aix-la-Chapelle, whose courses of instruction in the iron industry have of late years attained an eminent rank, has within the last year or so taken up metallography as part of its official plan of instruction. It may be worth while to present a few illustrations of the metallographical equipment of this institute.

The grinding of the specimens intended for microscopic examination is done, according to the almost universal practise in Germany, on rotating triplex cross-glued wooden disks on which are pasted the best emery paper. The following numbers are successively employed: 3, 2, 1G, 1M, 1F, 0, 00, 000, 0000. Then the specimens are polished with finest jewelers' rouge on a disk covered with cloth.

The entire microscopic and microphotographic equipment, except perhaps one microscope stand, came from the shops of the firm Carl Zeiss, of Jena. This microscope stand serves in connection with the lower power lenses for the preliminary investigation of the ground specimen, thus quickly and conveniently to follow the course of the grinding, polishing and etching.

For close examination of the prepared specimens, as well as for photographing them, the microphotographic apparatus shown in Fig. 1 is used. It consists of a Martens microscope with illuminating arrangement and photographic camera. They are placed separately on iron brackets bedded in the wall, most effectually to prevent vibrations, an absolute requisite to sharp photography with the stronger objectives.

The strongest magnification is, for direct observation, 1,000, and for photographs with the sensitive plate 1 meter away from the eye-piece, 4,000 diameters.

The construction of the Martens stand is shown in Fig. 2. Externally it differs from the ordinary form thru the horizontal, instead of vertical, position of its optical axis. The tube moved by wheels *A* carries an extension tube provided with a millimeter graduation for setting it at the lengths prescribed for the several objectives. The collar *B* is slipped on the holder of the eye-pieces, and in photographing forms the opaque coupling of microscope and camera, avoiding, however, actual contact between them. Fig. 3 shows how the shell *C* on the camera, when brought up to the microscope, enters the collar. If the stand is to be used for photographing without eye-piece the extension tube is entirely removed and replaced with a so called light-excluding shell, which after the removal of the one marked *C*, Fig. 3, may likewise be given a light-proof connection with the camera without touching it. This light-proof shell is shown on the Martens stand in Fig. 4. The objective can be given a rapid movement by the wheel *D*, or a fine one by the micrometer screw *E*, Fig. 2. On the latter a travel of the table as small as 0.005 millimeter (.0002 inch) may be read directly. The stage for mounting the object is revolvable and can, by co-ordinate drives, be moved in two mutually perpendicular directions, thus permitting a systematic examination of the specimen. Since it is generally necessary to mount the object exactly perpendicular to the axis of the microscope, there is placed on the stage proper a second, smaller, stage parallel with it and furnished with adjusting screws, by means of which an exact position may quickly and positively be given. The specimen, glued to a glass slide with a mixture of rosin and beeswax, is held against the smaller stage with screw clamps.

The illumination, which in the case of metal sections, as of all opaque objects, is by superficial light, is secured by the movable mirror shown in the illustration or a thin, flat glass so arranged that the day or lamp light falling perpendicular to the optical axis is reflected upon the specimen. Since this method of lighting is applicable only with objectives whose distance from the specimen is sufficiently great, resort is had in case of the stronger dry systems, as well as of the homogeneous immersion lenses, to the so-called vertical illuminator which is inserted between tube and objective. Its construction is obvious from the cuts. Fig. 5 shows it with an objective, the end of the tube being partly in section. From a side window before which, by means of pins, an iris diafram may be put up, the light falls on a little prism *G*, by whose hypothenuse face it is totally reflected thru the objective to the specimen.

A scheme of the lighting arrangement used with the vertical illuminator is presented in Fig. 4. The rays coming from the source of light—in our case a self-regulating arc lamp—pass thru a compound lens system, consisting of the double lens part *H* and the single lens part *J*, and fall on the window of the vertical illuminator. Between the double and single lenses is inserted a water chamber *K* for

the absorption of the so-called "heat rays" having great wave-lengths. For reducing the field of vision there is an iris diafram *L*, shown also in dotted lines at *M*. The former position is assumed when working without an objective and the latter when working with one.

The microphotographic camera Fig. 6 is intended for 24x24 centimeter (9.5x9.5 inch) plates; smaller ones can be used by inserting appropriate frames. Besides the usual double plate holders there is a so-called sliding holder which allows the repeated exposure on the same plate for selected lengths of time, of a small strip in the visual field, thus easily to determine a favorable exposure.

For examining and photographing larger objects, broken pieces, etc., where high magnification is not needed but facility of adjustment is desirable, the binocular coarse-work stand of Braus-Druener is used, Fig. 7. This also is a Zeiss instrument.

The apparatus, mounted on a heavy rectangular bed with three rack and four swiveling movements is adapted to the systematic inspection of large irregular bodies, wherein the comparatively long distance from the object is of advantage. Further, by means of the stereoscopic camera interchangeable with the double tube this stand performs a very valuable service and can best be appreciated in that connection. In direct examination with the lenses provided, a magnification of 10 to 65 diameters is attained, and in photographing with the stereoscopic camera 1.6 to 6.2 diameters. The depth of the sharp picture necessary to produce the idea of solidity varies, according to the degree of magnification, from 5 to 10 millimeters (.2 to .4 inch).

Finally must be mentioned an apparatus employed for manifold metallographic services—the tube furnace. The Eisenhuettenmaennische Institute has for many years employed almost exclusively the Heraeus electric refractory furnace, in which the refractory material consists of platinum foil 0.007 millimeter thick, which is wound in spiral form on a Marquardt tube. These furnaces are notable for swift, certain and regular service, and are to-day so improved with suitable heat-guarding arrangements that, for example, in a furnace 500 millimeters (19.7 inches) long and 30 millimeters (1.18 inches) broad a temperature of 1,450 degrees Cent. can be continuously produced without fear of the foil burning thru. Naturally, for furnaces of large section the high temperature permissible for continuous experiments is somewhat less.

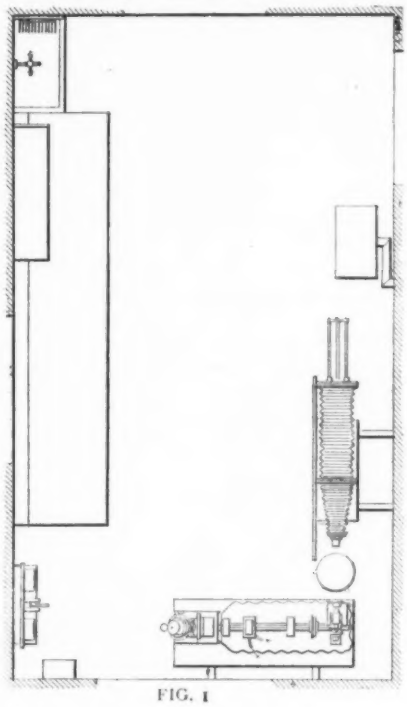


FIG. 1

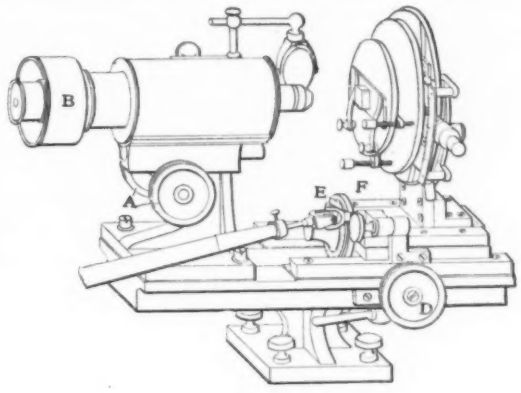


FIG. 2

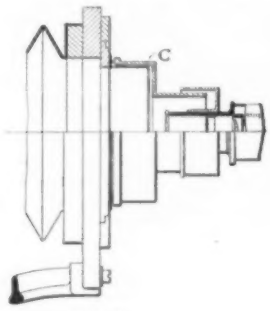


FIG. 3

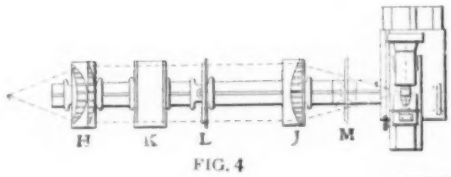


FIG. 4

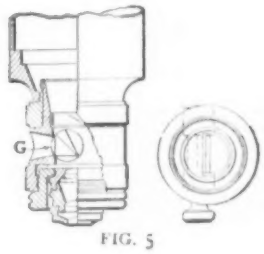


FIG. 5

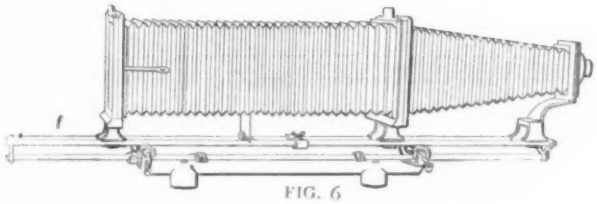


FIG. 6

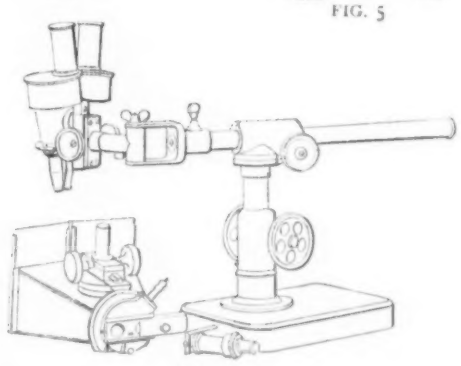


FIG. 7 *American Machinist*

GERMAN METALLOGRAPHICAL LABORATORY EQUIPMENT.

A Most Remarkable Machine.

A friend sends us a clipping from an Ohio paper which contains an account of an alleged new and wonderful invention which will take dictation and automatically write out the matter which has been dictated, thus entirely doing away with the stenographer and with the typist. We note that, according to the headlines of the article this machine is to do away with the "pretty" stenographer, and this we consider to be an especial grievance. We should not feel so bad about it if it would do away with the homely stenographer only, but if it is to do away with the pretty stenographer it will deprive many business offices of what is at present their only attractive feature.

Perhaps the most wonderful feature of this new machine is that one may dictate into it in any language he happens to be most conversant with, and the machine will typewrite it in any other language he may wish. That, truly, is a great invention, and a stroke of genius, and we know that our readers will be greatly interested in seeing a machine which can do such a thing. They may have to wait a long time, tho, because this is a machine which we should expect would require a lot of "perfecting" before it will work just right.

Molding a Rope Drive Flywheel.

BY R. H. PALMER.

This wheel, sufficiently shown in Fig. 1, has a wide face and two sets of arms. It is cast with sixteen rope grooves in the rim, these grooves to be afterward turned. The outline of the rim is shown in the mold Fig. 3. The wheel is cast to be split in halves and bolted together, the bolt holes being cored, with cores also for the parting. The wheel is cast in a pit, no curbing being used, the face, the hub and the arms being formed by cores.

The pit being dug and everything ready the spindle seat and spindle are placed, sand is rammed hard to the desired level and trued with the sweep. Sweep, finger and collar are removed, the lower half of the hub core is lowered over the spindle, raised to the proper hight and sand is rammed under it, as seen in Fig. 2, 2 being the hub core and 3 its supporting bed of sand. Finger 4, Fig. 3, is then lowered and a sweep is attached, which is to sweep line 5, Fig. 2, and on this sweep is placed a finger to set cores 6 the proper distance from the center. These cores 6 are made in two parts, the lower part, which is to have the lower part of the core 7, forming the outside of the wheel, bricked up against it at 8, Fig. 3, is made separate, say below line 9, while the part above line 9 has the notches in the core to form the inner projections 1, Fig. 1, on the rim.

Cinders are placed back of cores 6, sand is rammed up and struck off to line 5, and the sweep is removed. Split cores 10, having bolt-hole cores 11 thru them, are then set and sweep 4 is placed on the spindle. Pieces of board 12, Fig. 2, are laid on the bed, then the lower parts 13 of the arm cores, then the upper halves 14. As there is to be a space between the two sets of arm cores, a core 15 is made to form the hub in between. This core, a ring cut crossways so that it may be slipped on, each half sideways, is placed against the split cores. Blocks 16 are placed, the lower halves of the upper arm cores 17 are set, then cores 18, and with them the upper bolt-hole cores 19 of the hub; and then we have Fig. 2, but without the center core 20 or covering core 21 of the hub. The spindle is still sticking up in the center and from it the cores are all centered.

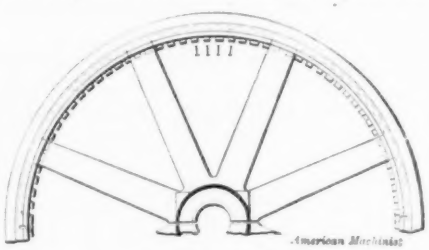


FIG. 1. A ROPE DRIVE FLYWHEEL.

Sand is now rammed in between the arm cores and the hub cores, up to the top of the wheel rim, a former being used around the outside. On the sweep is a part 23 which is to sweep the seating for the top cores, and as these cores are to have the tops of the outside cores, or the cores forming the face of the wheel, bear against them at 24, after this seating is swept this part is removed, and the cores are set and trued into position by the sweep, and back of these cores a channelway is formed and filled with cinders into which all vents from the inside of the wheel rim are brought. The sweep is removed and the spindle, and the face is finished. Split cores for splitting the rim, and bolt-hole cores are set by measure, as there is no print for them. Cores 7, Fig. 3, are now set around the outside, and where the split core is to come they are fitted to it. As they are placed they are braced from the side of the pit. The top parts of cores 7 have the holes for the flow-off.

Sand is then rammed in between the cores, and the sides of the pit. Some venting is done at the backs of the cores, as when these cores are made they must be vented thru from the back. When the sand is rammed nearly to the top a long vent wire is used, and vents are run down back of these cores 7, and the vents are covered with cinders as at 26, Fig. 4; these cinders are then covered with paper.

The center core is next set. It will be noticed how the chamber must be channeled to allow the split cores of the hub to cut into its smallest diameter. The covering core of the hub, having in it the holes for the gate cores and hub riser, is cut in halves on a line with the split core prints, and each half is tried on and set separately. Cinders are now placed around it and covered with paper, these cinders leading out to the pocket of cinders 27, Fig. 4. Sand is then rammed to the top and a piece of paper is put over the parting line with a hole in it for the vent hole in the center core. Cinders are run to pocket 27 and clamps are laid across it extending out far enough to come under the edges of the runner box 28 and timbers 29; papers are laid over cinders and rim. Runner box 28 is placed with the timbers 29 alongside it, the runner 30 is built with cores in the bottom of the basin. Weights 31 are placed on the timbers, wedges between the

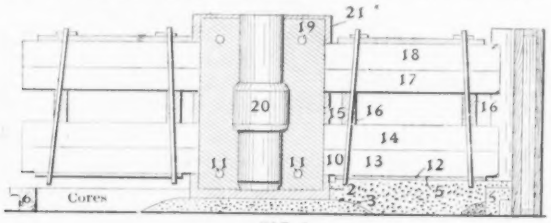


FIG. 2

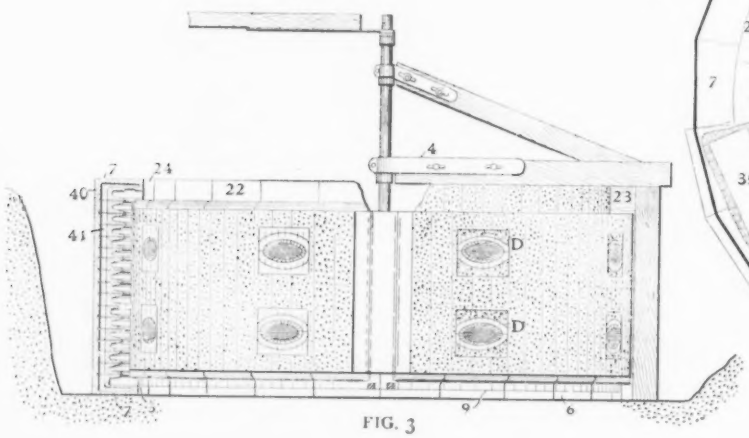


FIG. 3

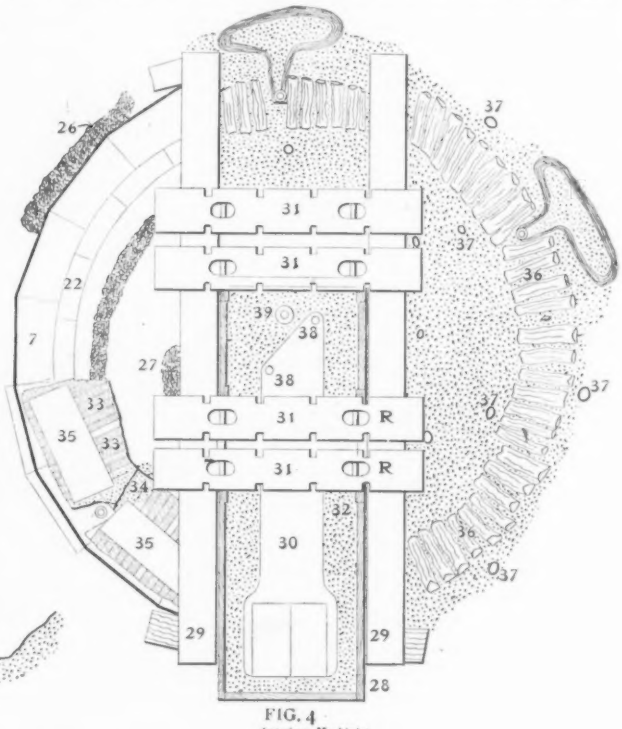


FIG. 4

MOLDING A ROPE DRIVE FLYWHEEL.

timbers and clamps over the hub covering core, also wedges between runner box and weights as 32.

Old newspapers 33, Fig. 4, are placed over the tops of the rim cores. Some sand is covered over them, as 34, and plates 35 are rubbed down to a bearing. Pig iron 36 is laid on the plates, and sand is spread over the paper that was laid over the cinder pockets and holes are made down to the cinders for the vent to escape, as at 37. Gatesticks are left in gates 38 until nearing pouring. The riser 39 thru which the wheel is churned is kept covered, balls of clay are used to cover flow-offs, and just before pouring the plugs are set over the gate holes and lifted out of the runner when it is half full. The riser 39 is rammed up inside a curb ring.

It will be seen that when the sand is rammed in between cores 7 and the sides of the pit, there must be a great deal of strain brought on the centers of the cores. For this reason, as the depth of the face of a wheel of this kind and made in this way increases, so must also increase the strength of the grid or carcass 40 and the thickness of core 7. The ribs of the core 7 which are to form the grooves in the face of the wheel are nailed, as 41, and vented to the back of the core. It will be seen how the upper and lower toes of the grid are arranged to carry the lower and upper parts of the core butting against the other cores.

Copies of the index for the second half of the AMERICAN MACHINIST for last year are ready and will be sent on request.

Die and Bender for Circuit Breaker Clips.

BY W. F. HOFFMAN.

The blanking and piercing die and the bender shown in the accompanying sketches were used for making circuit-breaker clips. The material was No. 14 B. & S. (0.064 inch) hard drawn copper. In Fig. 1 is shown the blanking and piercing die and punch, also the blank *A*, a section of the material as punched appearing also at *B*. It will be noticed that two operations are required to produce the blank *A*, but as they are combined in this one die a complete blank is produced at each stroke of the press.

Attention is called to the simplicity of this die. The punches especially are simple in construction, can easily be hardened without warping or getting out of shape, and after hardening they can be readily ground to fit the die.

In Fig. 1, *C* is the tool-steel die block worked out to the shapes shown, a slight clearance being given the dies to allow the punchings to drop thru. The dowel and screw holes are drilled, then the die is hardened and ground. *D* is the stripper plate, screwed and doweled on to the die block. This plate is worked out to the same shapes as the die; in addition it has a channel planed thru its length on the under side to allow the strip of material to be fed thru. The stop-finger *F* is attached to this plate. This style of stop was fully explained in the AMERICAN MACHINIST at page 1406, Vol. 27.

E is the gray-iron bolster machined as shown. In the upper view, Fig. 1, is shown the arrangement of the punches. *H* is the punch for cutting out the center of the blank, *K K* are the piercing punches for the holes in the blank. *N* is the finishing punch to which are attached the pilots *L* and *M*. The pilot *L* is screwed and doweled to the punch and *M* is driven into it. These pilots are used for guiding the strip after the first operation, in which the center opening is punched and the two round holes are pierced. The stock is brought forward to the stop-finger, then the punches in descending cause the pilots to enter that part of the strip previously punched, thus guiding the strip and in this way producing an accurate blank. It will be understood that this is necessary, as the strips are purposely cut to be a loose fit in the channel of the stripper. *G* is the punch plate, the punches being driven into this plate and riveted to prevent their pulling out. *W* is the punch holder.

The bender shown in Fig. 2 was used for forming and bending these clips in two operations; the sketch clearly shows the operations. I would, however, call attention to the guide pins *R* which go thru the die and rest on the tension pad under the bolster. These pins hold the blank in position while being formed. *S* is the bending die, *T* the forming punch, and *U* the bending punch. The punches are made to fit the slot in the punch holder *X* and are held in position by taper pins. *Y* shows the piece after the first operation and *Z* the finished clip.

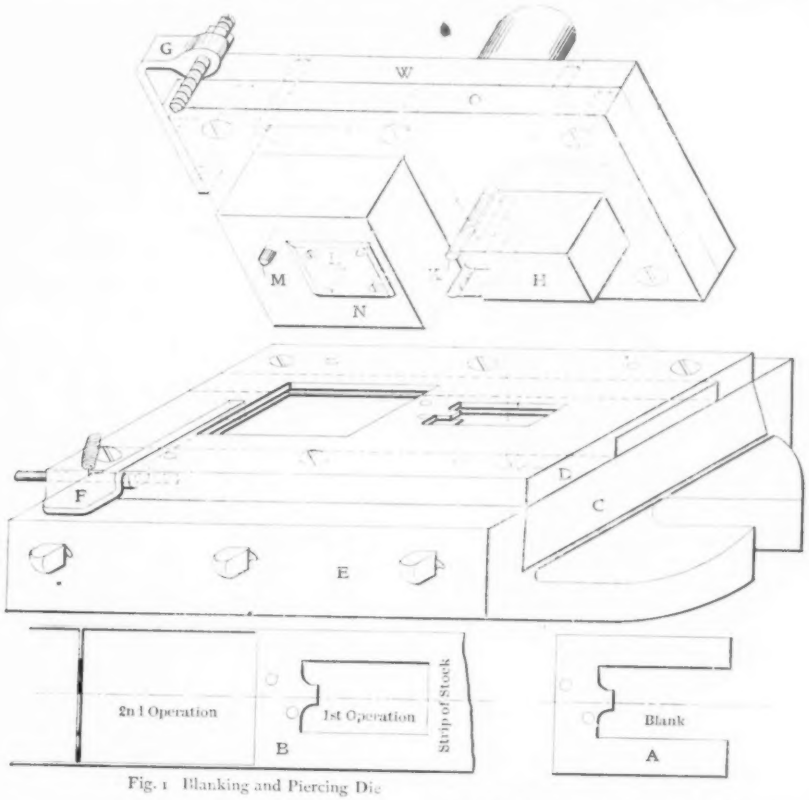


Fig. 1 Blanking and Piercing Die

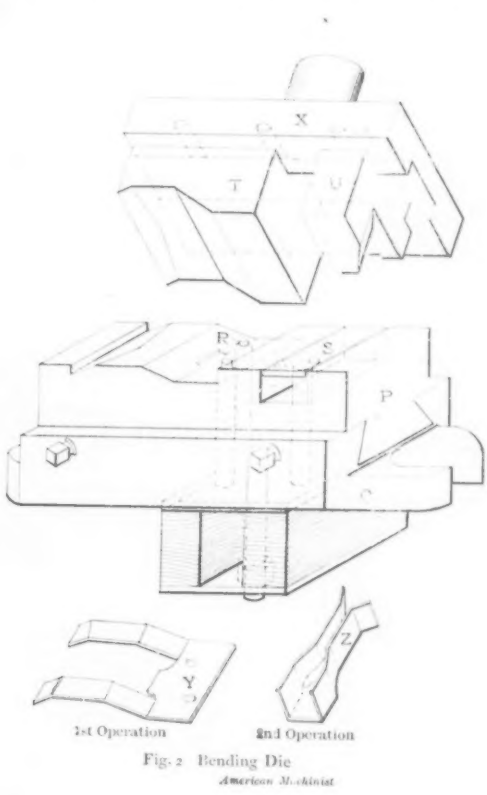


Fig. 2 Bending Die

American Machinist

DIE AND BENDER FOR CIRCUIT BREAKER CLIPS.

The die *P* and the punches *T* and *U* are hardened, thus adding to the life of the tool.

Manchester, England.

Controller for Induction Motors.

BY GAFFER.

In the shops of which I am superintendent a part of the machine-tool equipment is driven by individual induction motors which are of a type having an internal starting resistance in the armature actuated by a rod extending thru the outboard end of the motor shaft and terminating in a knob for the operator to grasp in regulating the resistance. An ordinary switch is also provided and completes the outfit as furnished by the motor builders. The control by these means is tedious and inconvenient as the regulating handle is attached to the motor where it is not always convenient to the operator and in consequence the services of an assistant are sometimes required. The motor builders were, however, unable to offer or suggest anything better. I have therefore designed the apparatus shown in the accompanying illustrations, which meets all requirements of a convenient controlling device. The main feature is the controlling of all moving parts from a central point.

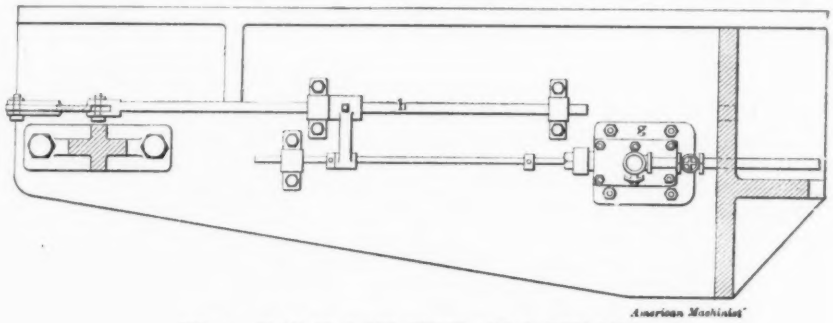


FIG. 4. PLAN OF VALVE CHEST AND TAPPET RODS.

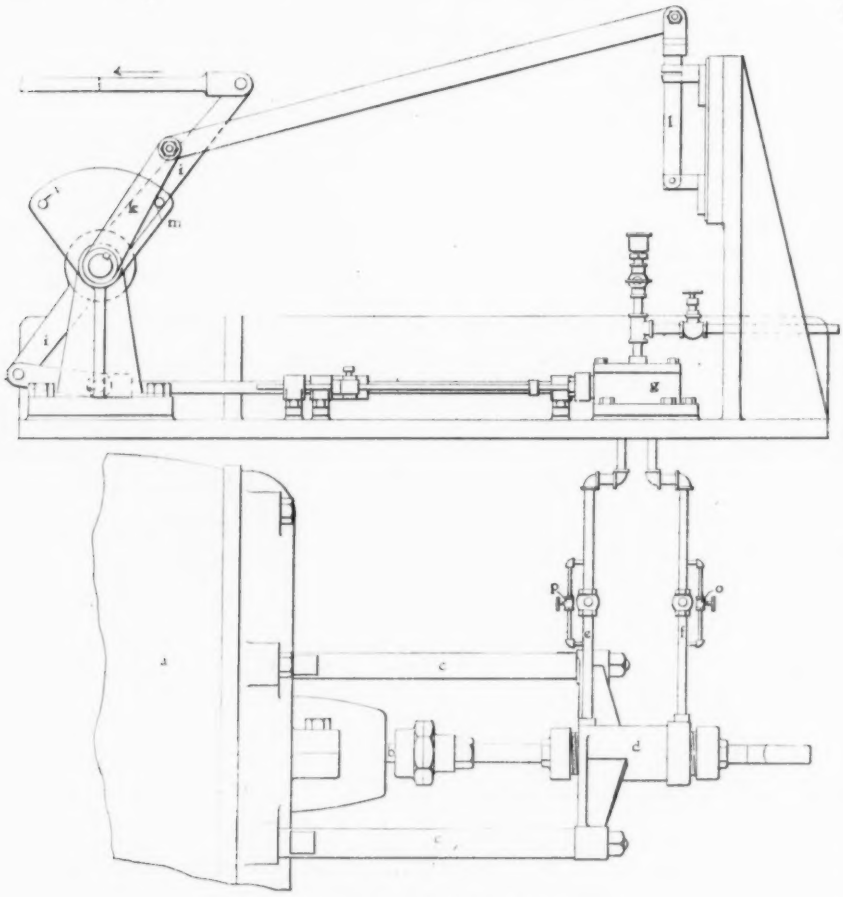


FIG. 1 General View of Apparatus

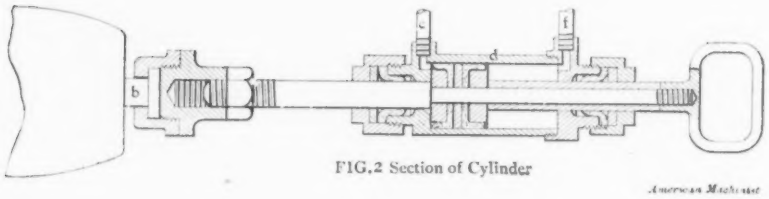


FIG. 2 Section of Cylinder

Referring to Fig. 1, *a* is the motor to be controlled and *b* is the sliding resistance rod. Supported by rods *c c* is an air cylinder *d*, shown in section in Fig. 2, having connected to each end air pipes *e f*, which are fitted with check valves and enter the valve chest *g*, shown in section in Fig. 3. Fig. 4 gives a plan of this chest and shows how the valve rod is actuated by tappets and an arm projecting from the rod *h*. This rod is in turn actuated by the lever *i*, Fig. 1, and connecting rod *j*, which latter is carried to a convenient point for the operator's hand. A second lever *k* is fulcrumed with the lever *i* and is connected to it by friction washers, as shown in Fig. 5, the office of this lever being to operate the switch *l*, as shown in Fig. 1. The movement of this second lever is limited by stop pins *m n*, Fig. 1.

When stopping the motor the rod *j* is pulled to the left, thus opening the switch, throwing the valve to the right and throwing the armature resistance in circuit. When the motor is next started, the first movement of the connecting rod closes the switch, continued movement of the rod reversing the valve and removing the resistance from circuit. The speed of this action is controlled by the by-pass valves *o p*, Fig. 1, thru which the check valves compel the exhaust to take place.

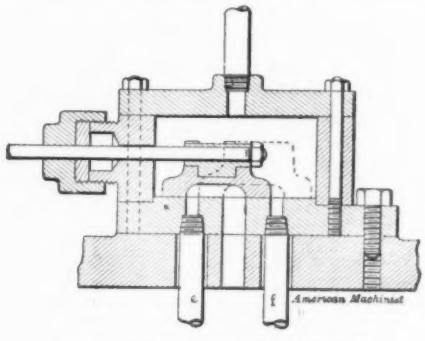


FIG. 3. SECTION OF VALVE CHEST.

Figs. 6 and 7 show the apparatus applied to a large cylinder boring machine, the main driving motor being shown at the right and the feed gear driving motor at the left. Under the stand of the former are two sets of the controlling apparatus, one for each motor. The control is obtained by two shafts near the floor—shown most clearly in Fig. 7—which have numerous cross holes for the insertion of levers at the point which is most convenient for the operator.

As shown in Figs. 2, 6 and 7, a bale is attached to the end of the piston rod for direct manipulation of the resistance.

Openings for American Manufactures Abroad.

There is ample opportunity abroad for the supplying of hydro-electric plants.

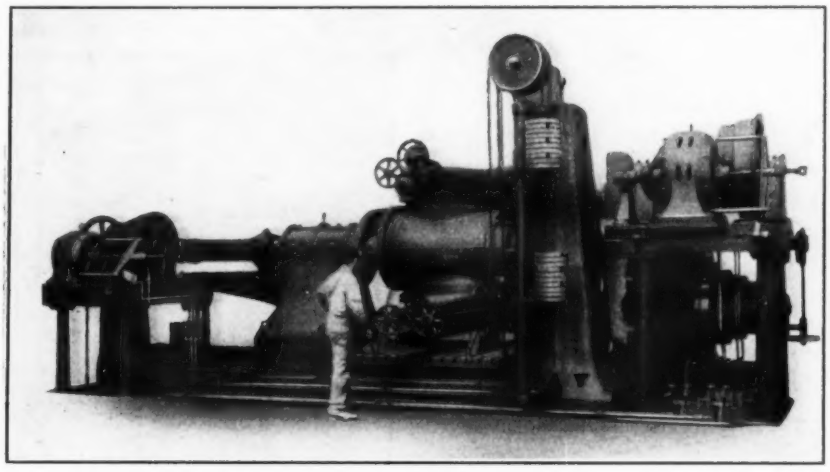


FIG. 6. BORING MACHINE FITTED WITH CONTROLLER.

Several undertakings are under official consideration for the construction and working of electric or hydraulic tramways in Durban, and also for the supply of electric power to the districts served by the proposed tramways.

In Italy a civil engineer, Signor L. Marcello Ciurlo, of Genoa, is obtaining local authority to use certain waterfalls for the production of power primarily for indus-

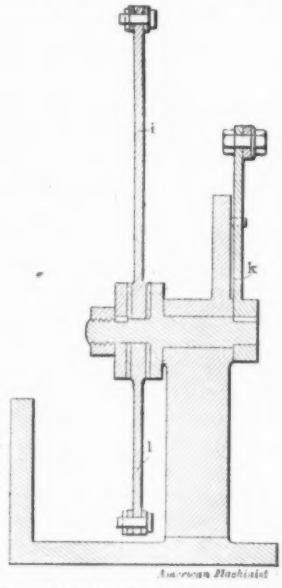


FIG. 5. SECTION OF OPERATING LEVERS.

trial purposes and eventually for electric traction. The cost of the works and machinery incidental is estimated at $125,000. The entire railroad system in and around Genoa is to be completely reorganized at a total of over twenty-five million dollars. It will involve the relaying of many lines, the introduction of numerous labor-saving plants, the use of block signalling, the erection of many steel bridges, the purchase of new locomotives, etc. The Italian Minister of Public Works has the scheme in hand. American manufacturers should communicate with the United States consul on the spot.

The Rio de Janeiro Tramway, Light & Power Company, of Rio, has taken over the concession which in 1900 was granted by the municipality of Rio to a local firm for the supply of electric current generated by water power. This company has a capital of $25,000,000, and will be spending large sums in the purchase of hydro-electric plant. The company is composed of American and Canadian capitalists and engineers, and the business will naturally remain on your side of the Atlantic.

In Mexico, Messrs. Quijaro and Rivero, of Puebla, have an undertaking in hand for the supply of water power. By their contract with the Mexican Government they may import their hydro-electric plant free of duty, and all their other necessary machinery. It is an undertaking that is worth looking after, from a manufacturer's point of view.

It is clear that your exporters of hardware and machinery would benefit largely by a rearrangement of the present commercial treaty existing between the United States and France. For instance, it works out in this way: Under the present treaty American sewing machines (taking them as a sample of many other things) imported into France from the United States pay an import duty of 50 francs ($10) per 100 kilograms (220 pounds). If a sewing ma-

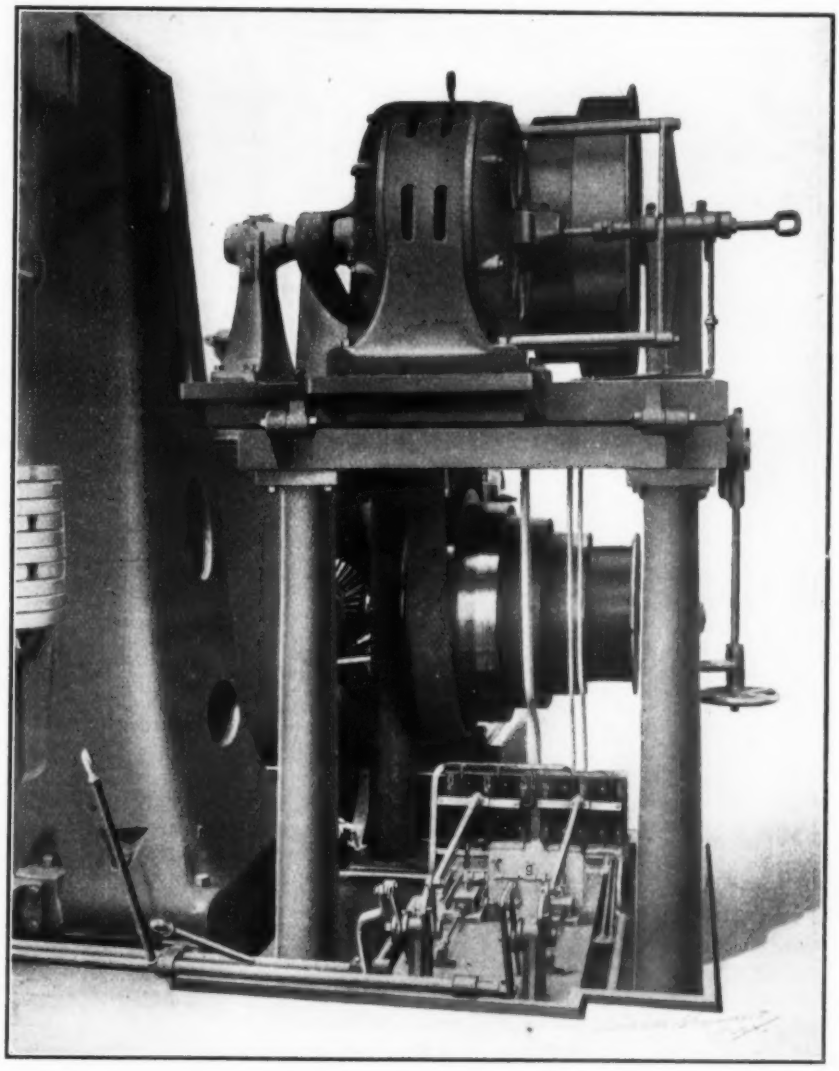


FIG. 7. ENLARGED VIEW OF CONTROLLER.

chine is imported from England, Germany, etc., it pays only 35 francs ($7). Your typewriters pay a duty of 150 francs ($30) per 220 pounds, whereas English and German makes are charged 100 francs ($20). Probably the British importing houses of these goods see no reason why any alteration should be made, as a large trade must necessarily pass thru them which would otherwise be transacted direct, to the benefit of the American manufacturer.

London. F. C. C.

According to the recently published report of the Institution of Mechanical Engineers, the society had an income last year of about $3,200 above its expenses, exclusive of receipts from initiation fees and life membership fees, which are carried to capital account. The capital of the Institution now amounts to over $225,000, some of which is in the form of railway share investments.

There were 4,477 members at the end of 1904, during which year there was a net gain of 266.

A New Hardening Furnace.

The half-tones, Figs. 1 and 2, illustrate a new hardening furnace invented by S. N. Brayshaw, of Manchester, England, and which makes use of a salt bath for heating the work, special provision being made for controlling the temperature of the bath as well as the whole interior of the furnace, and for handling the material to be hardened.

The inventor's contention is that the treatment of steel cannot be accurately regulated in an open furnace, and that it is necessary to immerse the steel in a liquid to be sure of its temperature to within a few degrees. Having experimented extensively with lead, he considers that a salt bath is better and has brought out a special preparation to be used as a bath in this furnace. The operation of the latter is based upon the laws controlling the heating and cooling of steel, and in this connection two heating and cooling curves taken by Mr. Brayshaw are of interest: One of these curves, Fig. 3, marked "S. & D. Best Cast Steel," is for ordinary carbon steel, and has been taken by drilling a hole into the piece of steel and inserting the pyrometer into this hole; the wires of the pyrometer being connected with the self-recording indicator. The piece of steel is then heated slowly and uniformly in an electric furnace. During the period of heating there is an arrest in temperature at about the point 726 degrees Cent. This arrest in temperature always occurs at the same point for the same steel. Of course it is understood that altho the temperature is not rising at this point the steel is absorbing heat from the furnace at a uniform rate all the time. After the absorption is complete the temperature again rises regularly as before. After the temperature has risen for some time the current is switched off and the steel is allowed to cool with the furnace. After cooling with a fair degree of uniformity for some time, it will be observed that the fall in temperature of the steel ceases, altho the cooling of the furnace and of the steel itself must be proceeding regularly. Not only does the temperature of the steel cease to fall, but it actually rises. On the curve in question the rise is only about 2 degrees. In some steels this rise is as much as 30 degrees Cent. After the temperature has risen and rested for a time, it again begins to fall as shown on the curve. The point where sensible cooling ceases and where there is an actual rise in temperature is the point of recalescence, and it will be noted that this point on the cooling curve is much lower than the point of absorption on the heating curve, and at first sight it might be supposed that this is due to lag

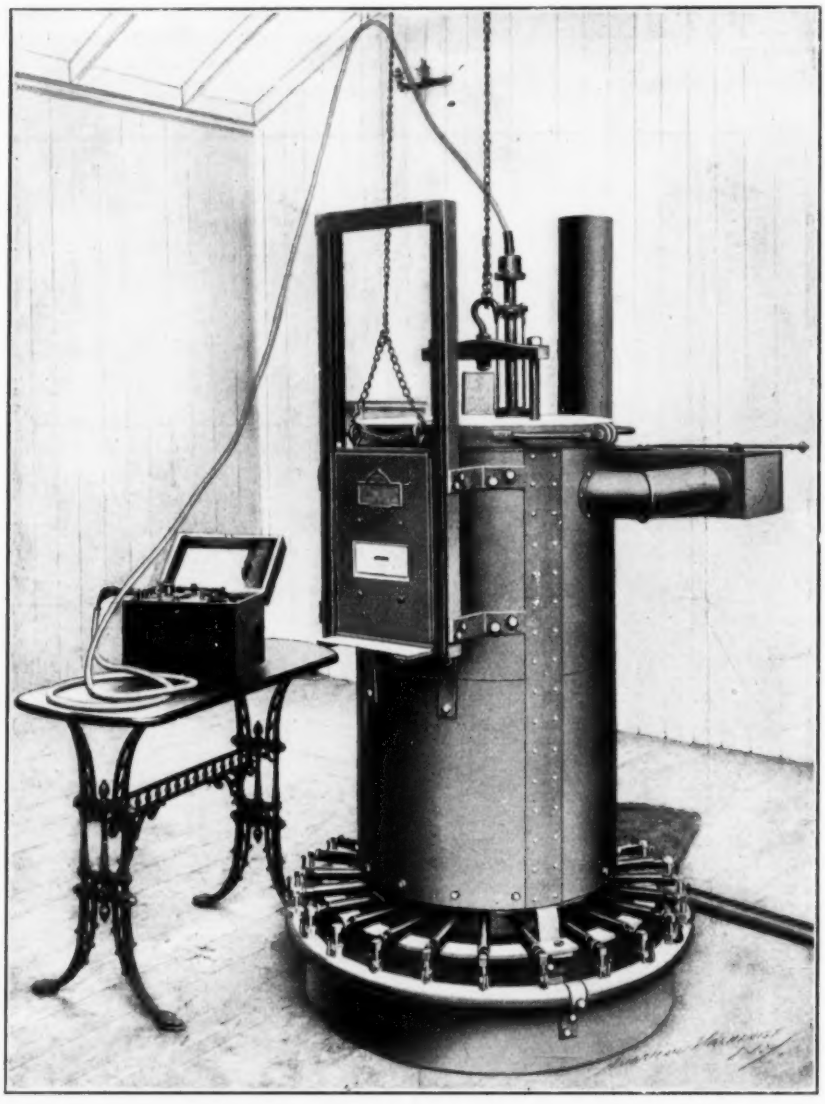


FIG. 1. HARDENING FURNACE.

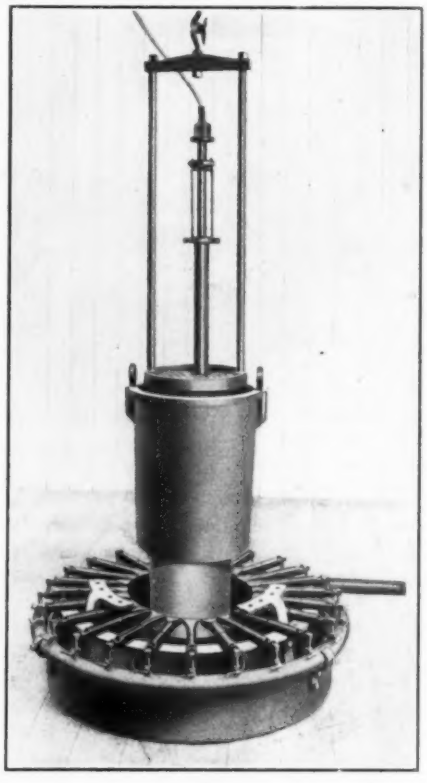


FIG. 2. SHOWING INTERIOR OF FURNACE.

in the instruments on which the curves were taken. It will be observed, however, that the curves have been taken very slowly, and as a matter of fact there is very little lag to be allowed for. It is in the steel itself that this difference arises.

The other curve, Fig. 4, is of S. & D. N. C. (New "Capital" High Speed Steel). This curve differs very remarkably from the curve of the ordinary carbon steel. Both the absorption point and the recalescence point are very gradual and it is very difficult to say where they begin and end. Mr. Brayshaw bases his treatment entirely on the curve. He has found it impossible to harden steel, no matter how many hours it may be soaked, at any temperature below the absorption point. For good hardening the temperature must be raised so that the absorption of heat is complete, but when this has been done the temperature may be lowered very considerably so long as recalescence does not begin—that is to say (referring to the diagram in Fig. 3), the steel from which this curve has been taken must be heated to a point above 726 Cent., but it may then be lowered in temperature to about 710 degrees Cent., and it will still harden perfectly.

By adopting this method, therefore, of heating carefully to a point a little above the absorption point and then lowering the temperature, it is possible to harden steel at a very low point indeed, which means that the risk of breakage is eliminated and warping is reduced to a minimum.

To utilize this principle, in the design of the furnace a crucible is included for holding the salt bath, and numerous Bunsen burners provided at the base for heating crucible, liquid and furnace lining, the temperature being determined by an electric pyrometer which passes thru the furnace cover and rests in the bath, and is read by means of a Whipple indicator which in Fig. 1 will be seen on the stand at the side of the furnace. By watching the indicator and regulating the burners the temperature may be raised or lowered, or it may be maintained at any point desired.

A counterbalanced tray with perforated bottom, as in Fig. 2, holds the work and the latter may be lifted clear of the bath without changing its temperature, as the whole interior of the furnace is practically at the same temperature as the salt mixture.

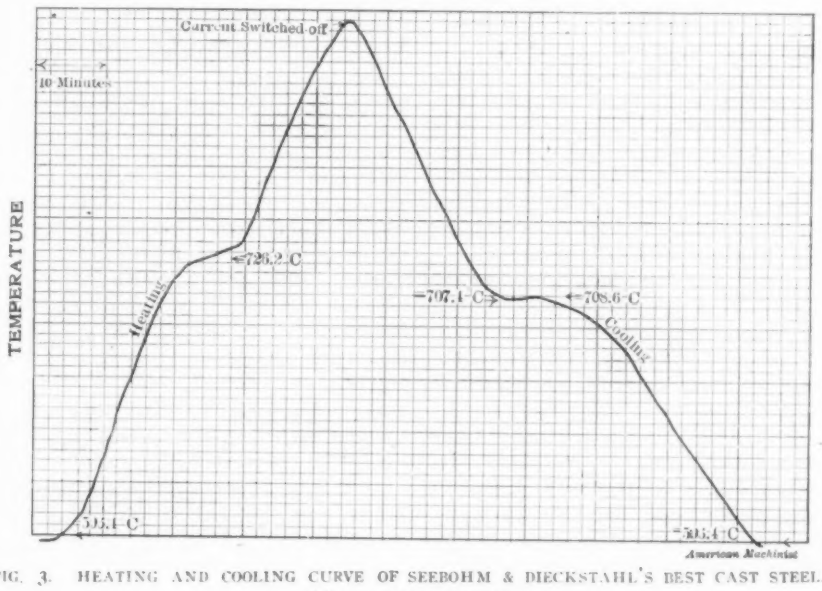


FIG. 3. HEATING AND COOLING CURVE OF SEEBOHM & DIECKSTAHL'S BEST CAST STEEL. 1⅛ PER CENT. CARBON.

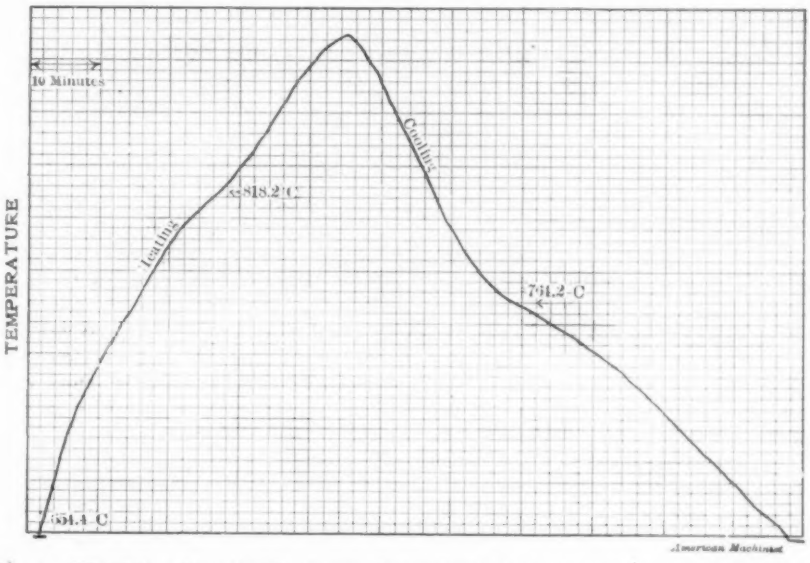


FIG. 4. HEATING AND COOLING CURVE OF SEEBOHM & DIECKSTAHL'S N. C. HIGH-SPEED STEEL.

For handling small pieces rapidly in this furnace a set of grids or open racks are supplied which, resting one upon another on the perforated tray, allow the liquid to reach every part of the work and bring it to its own temperature.

This furnace has been in operation for some time at the New York office of Geo. Nash & Co., 224 Pearl street, who control the furnace in the United States.

The Commercial Aspect of Engineering.

We abstract the following interesting paragraphs from a paper by Chas. A. S. Howlett as printed in the *Journal of the Western Society of Engineers:*

Contracting or sales engineers may be compared to the motive power of a machine, or we may say they are the ones that primarily make the smoke come out of the chimney. The volume of the smoke or the amount of the dividends varies directly as the amount of the contracts. Contracts are secured for the purpose of making money for someone. They are not unlike the golden nuggets themselves; you have to dig for them, and it usually takes a lot of good, hard, patient work to loosen them up so that they can be gathered in.

The presidents of our large manufacturing and engineering organizations are very good examples of successful contracting and sales engineers. They possess traits that are inborn, and others that are developed, which enable them to successfully influence others. And this definition applies equally well to a successful lawyer or preacher and to many other professional men. This distinction should be kept in mind, however. After a contracting or sales engineer has attended to the commercial side of his work, he must immediately proceed to carry out the work without fault or blemish, whether it be the furnishing of engineering knowledge or of machinery, or both. His ultimate success depends greatly upon a diligent attention to details, harnessed to an extended experience, which should produce successful work.

Success in the commercial phase of the work, without proper support from a purely engineering standpoint would be more embarrassing than a thorough knowledge of the engineering features, without any

commercial capacity. The success of the contracting or sales engineer depends on his salesmanship first, and his engineering ability second.

This will be disputed by some who claim that both should be equally developed. Theoretically this is correct, but practically it is not, due to the fact that from the nature of their training there are comparatively few engineers with a knowledge of salesmanship. Therefore, when several are endeavoring to secure a contract for machinery, or for services as engineer, the questions discussed do not require as thorough a knowledge and familiarity with the purely engineering problems involved as the ability to secure the contract. The one most proficient in the selling art will naturally be the most successful.

It is practically an accepted fact that success, either in securing contracts or anything else, depends absolutely on one's personality, capacity to influence others, character and health. The question of health is a long story about which most of us have our decided views. The principal elements of character are self-reliance, courage, firmness, energy, system, application, persistence and enterprise. Rubbing up against adversity, and the peculiar characters one meets in this rough world, it will be found necessary to have a bounteous supply of courtesy, cheerfulness, sympathy and tact. In the make-up of a winning personality, the trait of greatest importance is undoubtedly t-a-c-t—tact.

An old salesman, in telling of his experiences, drew a parallel case between a preacher and a salesman. In both cases they are trying to overcome the prejudices and convince the reason of other men, and neither will accomplish much unless he is in dead earnest. Both young salesmen and young preachers are likely to think too much about themselves and too little about their work. They are continually getting their feelings hurt and are always thinking that someone is trying to insult or slight them. As a result they do not accomplish much. But you fill a man so full of the spirit of the gospel that he is almost running over with it, and he'll go out and preach sermons that will move men and win him a place in the ranks of successful preachers. In the same way a salesman who hopes to be permanently successful must pump himself full of the especial virtues of his proposition until when he meets the prospective purchaser he thinks nothing at all of his insignificant self.

The average college-bred engineer receives a very thorough training in all manner of studies, the object being to enable the graduate to tackle, and successfully solve, engineering problems. But, unfortunately, the average engineer receives absolutely no training in the development of the mind or in any other way to enable him to secure the opportunity to solve the problems. If shortly after graduation, with finishing touches in some large factory, the embryo engineer starts into business, he is confronted with the very perplexing problem of *how* to secure the contracts for his services. He will find a number of experienced men after the same contract, and he will realize that before he can presume to have the standing of his senior competitors he must have carried to successful completion a number of contracts. But how is he to secure them?

Many young engineers in this predicament find that it is necessary to spend considerable time to obtain by actual experience a knowledge of the commercial phase of their profession. Would not our engineering school training, then, be much more complete and a great deal more beneficial if it embraced studies that would give us the benefit of the successful commercial side of the profession, as well as the purely engineering? Why cannot we be taught to take advantage of the experience of the successful salesman?

Some will say that the art of securing the contracts is a gift, and maybe it is. If so, Dame Nature was not very generous when she distributed her gifts among the professional men. I would say that salesmanship is not a gift necessarily, but the development of certain traits more or less common to all of us. Those with natural instincts will be more highly developed with the same training than those less gifted; in the same way that those with inborn musical instincts will be more proficient musicians, with the same training, than those less gifted.

DISCUSSION.

The following is abstracted from the remarks of a number of speakers who followed Mr. Howlett:

W. B. Hale (chairman)—The engineer has been defined as the man who can do with one dollar what any fool can do with two. To supplement this definition, I will say that after the engineer has done the job for one dollar the commercial man comes along and takes ninety-five cents of it as his share! That seems hardly fair.

In all great engineering enterprises we see at the head the executive officers—which is as it should be; next come the commercial men, and finally, away down at the bottom, at least so far as salary is concerned, we find the engineer. The question therefore arises, why should the man who sells the dynamo receive a larger compensation than the man who designs it? Does the trouble lie with the engineer himself, or is it, as Mr. Howlett suggests, that his education is at fault? Is his training so technical and so elaborate that he leaves college without a clear idea of the commercial basis upon which engineering to be successful must rest? Is he too familiar with the molecular theory and too ignorant of human nature?

H. Almert—Engineers, as a general proposition, are very poor speakers. I think we would get along much better if we had to do more speaking. A great many engineers connected with manufacturing concerns or operating plants would like to present many things to the interest of the corporations if they only had the ability to appear before their boards of directors and present them in a good, intelligent manner. I dare say that a very high percentage, who are very capable men in their own work, who direct and execute it well, and who would not hesitate a moment to tackle a man twice their size in physical combat, could not get up and face a board of directors—to say nothing of facing strangers—and in presenting matters of interest they often forget everything that they had prepared to say. This is unfortunate.

The engineer has a limited field as a rule in his chosen line. In certain positions (with large corporations, for instance) the engineer has to handle a good many men, and there the question of executive ability comes in. I was directly interested in a case a short time ago, where the lack of executive ability in the handling of men in general resulted in a considerable loss to the company with which this man was connected, and also to the customers. But take this same engineer, put him in a shop by himself where he is perfectly at home with his work or at the drafting board, and he can design and execute as much work as any man I know of. In the direction of men, however, he could do nothing, and in the office he was manifestly out of place.

With a smaller establishment the engineer must necessarily combine the commercial work with the engineering; he must be able, when a good-sized customer comes in, to go into the commercial side as well as the engineering side of the problem. Then, outside of the manufacturing end, in connection with the operating of plants, he is affected in various ways. After I had spent ten or twelve years in the study of electrical engineering I thought I was pretty well fitted to cope with the world, but I very soon found I had only just begun to learn and I have gotten now only a fair start. I soon found that the very elaborate specifications I prepared as to the quality of materials, etc., that were to be purchased, availed me nothing, because of the introduction of some simple little clause into the contract by the salesman, who, while he might not understand all of the technical points involved, was shrewd enough to prepare his contract so as to protect himself. Along these lines a contract was let recently where the specifications were very carefully drawn up and submitted to the manufacturers; they were readily accepted by some and not so readily by others, but all accepted them eventually. But when it came to the contract all were very much surprised but accepted all the conditions of the same except one (the penalty clause). When it came down to that there was only one concern out of six or eight that would accept such a contract. Everything thus went along smoothly as far as the engineering features were concerned until they came to the commercial aspect,

and when they looked at that it was an entirely different matter. The engineer is very severely handicapped by such matters.

Mr. Beattys—A salesman of one of the companies doing business many years ago in Chicago told how he was sent to Indianapolis in the early days to secure a contract in competition with all of the other dynamo manufacturers who also sent representatives for this same contract. The gentleman in question represented one of the largest companies then in existence, and the competitors were brought before the council and allowed to listen to one another's arguments. The gentleman made the assertion that his company operated 90 per cent. of the plants installed in Cook county, which was true at that time. After a great deal of difficulty he obtained the contract on the strength of that assertion, and then going to one of his competitors he said, "You are all a pack of cowards." "Well," replied the competitor, "what you said was true." He replied, "What if it was? you are here to sell the goods and not to listen to the truth." But we believe, the most of us, that it is our business not only to obtain the contract but to retain the business. The man who misrepresents may obtain one contract, but he is not likely to obtain another from the same company. Selling goods costs money, and if we can secure a customer and retain his trade we can make future sales at slight expense and are reducing the cost of goods to our own company. In other words, we are able to place the apparatus in the customer's hands at less money if we are not obliged to convince him time and again on each proposition that comes up as to the merits of our apparatus and our veracity in exploiting it.

Mr. DeCrow—I think that there exists a class of men who will never become salesmen, and they do not start out with the idea of being salesmen, but strictly engineers. There are undoubtedly engineers who, thru a combination of circumstances, occasionally "butt" up against sales propositions without preparation and who have consequently sometimes fallen down. but I think the cases are very few indeed, where engineers decide to enter the sales end of the business with due preparation for it, that they are unsuccessful. The engineering salesman has in some respects a difficult problem. There are undoubtedly times when he cannot go before the prospective customer and present his goods with as much fervor as he might, if he did not know so much about their lack of adaptability to the cases in which they are expected to fit. A salesman without engineering knowledge can generally educate himself as to what he is going after, and, getting the job, be totally unconscious of the fact that he has furnished the customer what he really ought not to have; whereas the engineering salesman, perhaps in representing the same manufacturing company, would fail largely because his company did not produce the goods ideally fitted to the customer's demands. Naturally, no matter how high the class of goods or how wide the producer's scope of production, the engineering salesman is occasionally called upon to sell something which he really feels is imperfectly suited to the case. But, after all, I think it is a good asset to be able to discriminate and not sell what should not be sold.

Mr. Hine—The salesman runs up against all sorts of unexpected experiences. I had a curious case not long ago in connection with a large contract, where I was assured I would have the preference There were six bids submitted for apparatus. I had done quite a large amount of engineering work on the job, and things seemed to be going my way. At the last moment I was sent for and the agent said: "We assured you we would give you the preference for this job. What we propose to do is this: Here is a record of all the bids received. We have added them all up, the aggregate is so much; we propose to divide that by six and offer you the contract at the average price." I took the contract. The problem never had been put to me that way before, and when the matter was closed they said, "We were afraid you would accept." I said, "Why?" They replied, "Since you have been here we have had two or three telephone messages about this job, and we are satisfied that most any one of your competitors would have reduced his bid by a large amount to receive the contract." My bid was not the highest and was not the lowest. The result was, it made a small reduction in my price.

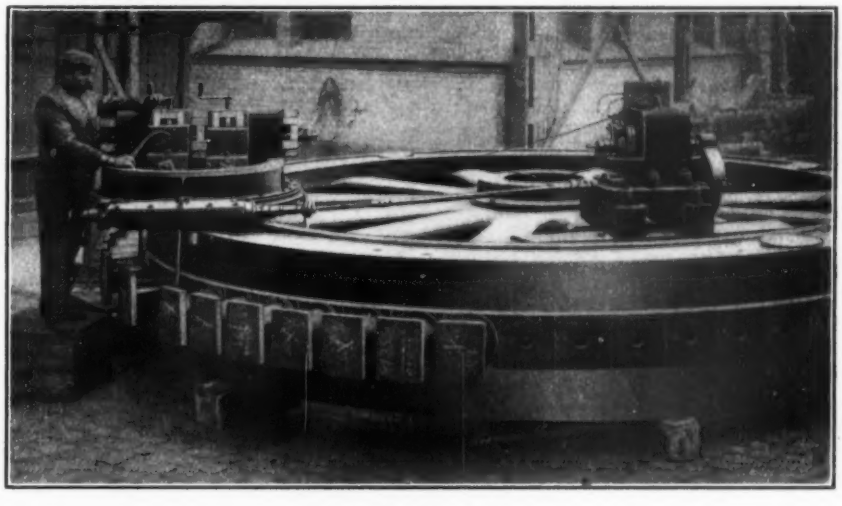
Mr. Beattys—I think the engineer is apt to look at the salesman as being lower down in the scale than he, and I believe that the salesman who has had an engineering education perhaps will not be able to talk as smoothly as a salesman who has not, because his engineering knowledge may prevent his making such broad assertions as a less technical man might make. It sometimes does win temporary success to be able to make certain assertions of which you are ignorant and of which your customers also are ignorant, but I do believe that the growing intelligence of the American business man will demand that, in presenting a proposition, the truth be strictly adhered to, and that we must know what we are talking about.

Mr. Hine—I think the days of misrepresentation have long been past. I remember a conversation I had once with a representative of the Westinghouse Company who was talking about the ratio of shop cost to selling expense. He said, "At Pittsburg and Newark we try to see how we can save a dollar in the construction of a dynamo, and if we succeed in doing that we feel that we have really accomplished something, while you fellows go out and drink up six dynamos in one night." Those times have passed. Business is now done on a higher plane, and methods are growing better and better all the time. I am a firm believer in the upward progress of the race.

Portable Turning Mill, With Electrical Drive.

BY EMIL GUARINI.

The illustration shows a portable turning mill introduced by the Lahmeyer Electrical Company, of Frankfort, Germany. It is at work turning the lugs on the sides of a large armature. These lugs are at the junction of the segments and are for the reception of the shrinking links. The machine consists of a worm-driven turntable upon which is mounted a cross-rail having two tool slides. It is driven by a portable electric motor, as shown.



PORTABLE TURNING MILL.

To correct the "tumbling" of the projectiles of 10 and 12-inch navy guns, they are all to be rebanded. An appropriation from Congress will be required.

If you have much belt lacing to do, it is not a bad idea to burn the pointed ends of the laces. It stiffens them and makes them handier to insert.

Some Shop Tools and Methods.

BY F. A. STANLEY.

The advantages of step chucks and closers as applied first to bench lathes are well known to all toolmakers; and some application of these handy devices to larger machines and heavier work should be of interest.

For a long time the Pratt & Whitney Company have fitted such chucks to their 10-inch toolmakers' lathe and 14-inch engine lathe, and more recently have applied them to their new model turret lathes. They also use them in connection with a number of their screw shavers in operation at the works, and find them exceedingly convenient when facing up washers, thin collars, rings, etc., which afterward may or may not be hardened and ground.

TURRET LATHE STEP CHUCKS AND CLOSERS.

For the 2x26-inch turret lathe the chucks are made to receive work up to 6 inches diameter, and are therefore useful for facing change gear blanks and for handling many other parts coming within their capacity. A blank chuck and its closer and holding-in rod are shown clearly in Fig. 1 and the method of attaching to the turret machine spindle is represented in Fig. 2. With this machine, it will be recalled, the regular chuck jaws for bar stock are tightened on the work by pushing forward a hardened closer, the jaws themselves being prevented by the spindle cap or chuck from moving endwise. Similarly in the application of the step chuck, this member is held against end movement, in opening and closing; hence duplicate parts may be faced to exact width or thickness, without adjusting the cutting tool for each piece.

The special closer takes a fit in the hardened ring at the mouth of the spindle, and at its rear end is reduced to fit the spindle bore. The chuck is drawn back and held against forward movement by the threaded rod, which has at its rear end a collar abutting against the end of the spindle. The closer is prevented from turning in the spindle and the chuck from turning in the closer, by the means indicated. The closer is thrown forward to grip the chuck on the work by the regular chucking lever and tube, and is pushed back, when released, by three spring plugs, the outer ends of which rest against the rear of the chuck.

The chucks are usually of gray iron for the larger sizes, machine steel for the small sizes, and are left blank to be bored to the required diameter by the user. When so desired, they may be bored large and fitted with hardened and ground tool steel shoes, altho ordinarily such practise is not necessary.

SCREW SHAVER STEP CHUCKS AND CLOSERS.

Fig. 3 shows a Pratt & Whitney screw shaver, which is one of several in operation in their screw machine department, and which is fitted with a set of step chucks receiving work ranging up to nearly 4 inches diameter. A good many rings and thin collars are manufactured in this department, and after these are drilled, turned and cut off in the screw machine, the screw shaver is found to be the best place to finish the faces. Many of these pieces are to be hardened and ground later, in such cases a few thousandths being left at either side and in the bore, for finishing with the emery wheel. The machine illustrated has been equipped with a spindle like that used on the 1x10-inch new model turret lathe, and hence in operation the chuck may be closed on the piece with the same freedom from end motion already noted in connection with the larger machine.

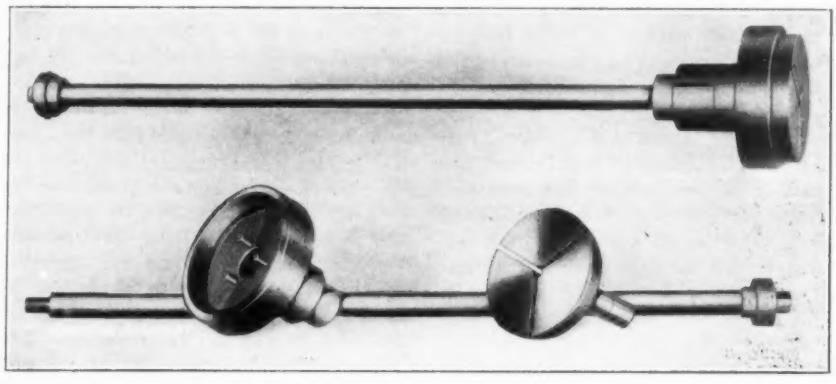


FIG. 1. A BLANK STEP CHUCK WITH CLOSER AND DRAWING-IN ROD.

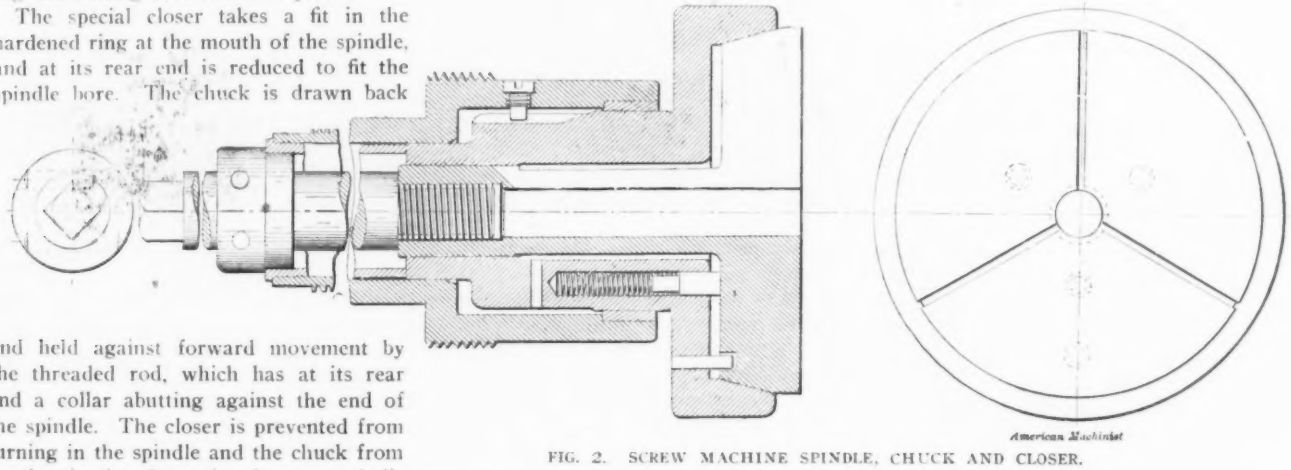


FIG. 2. SCREW MACHINE SPINDLE, CHUCK AND CLOSER.

MULTIPLE THREAD CUTTING.

A good many schemes for indexing in multiple thread cutting have been described first and last; but about as interesting a one as I recall having seen I ran across the other day at the Pratt & Whitney shops. They were making in a 16-inch lathe a number of special, steel nuts which were quintuple thread with a lead of a little over 2 inches, the blanks being about 3 inches square by 2¾ inches long, and the diameter of the thread approximated 2 inches. As it was impracticable to drive the lead screw at the high speed ratio necessary for a thread of this lead, a new screw and nut were made, but of sextuple thread and 1-inch lead, the screw being cut in the thread miller. Then the required gear for the driving stud was put in a lathe and two of the arms spotted off true to receive a steel plate, which was screwed and doweled in place, as in the rough sketch, Fig. 4, and this plate was bored out to receive a ½-inch locking pin. An index disk of about the same diameter as the stud gear, and provided with five accurately spaced holes to receive the locking pin, was keyed to the driving stud, and the gear slipped on at the outer end. The work was held in a four-jaw chuck, and after the hole was bored a thread tool —a round bar with an inserted cutter— was clamped in a V-holder on the toolblock, and one thread grobve cut down to depth but 0.02 inch narrow. Then the locking pin in the gear was withdrawn, the spindle turned until the pin entered the next hole in the index disk, and the second groove was cut. After all the five threads had been roughed out, a finishing tool was put in the holder and the threads were quickly finished.

The Speed of Patternmakers' Lathes.

A foreign correspondent having asked us for the proper cutting speed of a wood-turning lathe to be used for patternmaking, we have asked our contributor, John M. Richardson, to answer the question from the standpoint of a practical patternmaker and he replies as follows:

"As to the speed of a lathe and the surface speed for wood: for two lathes I have in mind, one a 24-inch and the other a 16-inch patternmaker's lathe, they are belted for a speed of about 2,000 and 3,500 turns per minute, respectively, for the smallest step of cone, and give good service. The former runs rather too slowly for ordinary small turning, but is right for larger work. The smaller lathe at the speed given gives good results for a range of small work. Speed lathes for work of very small diameter, as handles and the like, frequently run from 4,500 to 6,000 turns per minute,-but this is too fast for patternmaking.

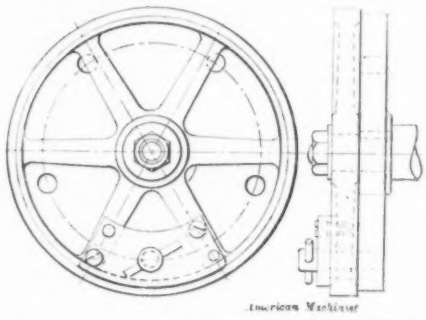


FIG. 4. INDEX RIG FOR MULTIPLE THREAD CUTTING.

"It seems to me that no definite rule for surface speed can be given for pattern work, owing to the large diameters frequently turned and the attendant centrifugal force. It must be borne in mind that it is impossible to run a large piece of work at its maximum speed until it has been completely roughed out and brought into balance, and the job is usually nearly completed before all parts have been thus treated. I am speaking now of face-plate work, which is almost always built up of rough segments. To a patternmaker the speed is a matter of experience and becomes second nature; he usually runs his work as fast as the lathe will stand without shaking, and on very thin work as fast as possible without its being demolished by centrifugal force when of large diameter. Possibly 2,000 feet per minute or slightly over would be somewhere near the common practise for surface speed for the work after being brought into balance."

Re-Organization of the Cincinnati Milling Machine Company.

Fred Holz, president of the Cincinnati Milling Machine Company, having desired to retire from active service, has resigned his position, disposing of part of his holdings to Fred A. Geier. The company has been reorganized, the stock being distributed among the active workers of the concern. The new officers of the company are: Fred A. Geier, president; C. Wood Walter, secretary; G. A. Mayer, treasurer. The above, together with E. M. Chace and P. O. Geier, are the present Board of Directors. The company is enjoying a fine business, and is making further extensions to its plant.

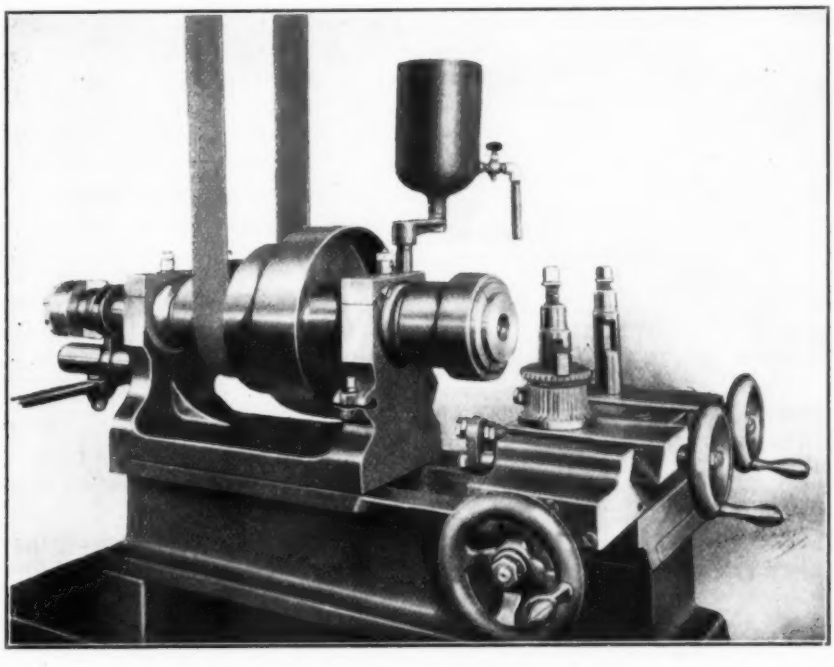


FIG. 3. SCREW SHAVER FITTED WITH STEP CHUCK.

Steam for residence heating in Detroit costs 47 cents per 1,000 pounds of condensed steam, which is said to be 25 cents per square foot of radiating surface per season.

Letters to the Editor.

British Machine Tool Manufacture.

A subject which I think is worthy of free ventilation in your paper is the present condition of the British engineering industry, more particularly the machine-tool section; by this I mean the methods, shops, workmen, etc., compared with those of America, Germany and other competitive nations. Of course I am well aware there has been a lot of ink spilled lately by the technical press, both for and against British industrial supremacy. What I want to see and read is similar articles written by the shopmen themselves, so that the conditions generally of British engineers throughout the country may be judged. It is a letter of this sort I am writing, giving my views and impressions on the subject, and I shall confine myself to statements of facts which have come under my own notice.

FOOTBALL.

An impression that has considerable hold on foreigners, Americans in particular, is that the British workman spends the whole of his time thinking about or going to football and cricket matches—that is, if there happens to be a football match in the middle of the week (a very rare occurrence in our district, the West Riding of Yorkshire) he would much rather miss his work than this particular match. Now, I want to correct this impression. In our shop and all other shops in this town, and there will be three or four thousand mechanics engaged, it is a very rare occurrence for anyone to stop off to attend a football or cricket match. On a Saturday afternoon nearly all these men are following football either as players or spectators, and in my opinion they could be doing nothing better. The healthy excitement of a good football match goes far toward removing the tired and wearied feelings after a week's work, and gets the mind in good trim for another start on the Monday. Office men in particular are much benefited by taking some part in a football match. I myself am a draftsman and I can truthfully say that I enjoy better health when playing football every Saturday than when I am loafing aimlessly about—of course, this is barring accidents—and I have yet to find a better antidote for brain fag than either playing or watching football.

SUSPICIOUS WORKMEN.

I have found, however, that a lot of workmen are very suspicious, seeming to think their employers are trying to take advantage of them at every turn. For example, a few years ago I started a club at our works for the purpose of getting a weekly parcel of the AMERICAN MACHINIST. The boss allowed me to go round to the men, canvassing during working hours, and I succeeded in getting twenty-five names. I got the papers, for which I paid twopence each, selling them to

the men at twopence halfpenny to cover the cost of postage. All went well for a week or two; then I began to have copies left on my hands. This went on till one day I had six left which I had to pay for, so I resigned and told the boss. He said he would order the papers and let anyone have a copy at twopence, paying for the postage out of his own pocket, his only stipulation being that the twopence should be stopped out of their wages every week, to save the trouble of collecting it. I wrote a notice to this effect, asking anyone to sign his name who wanted a copy weekly; after two days there were two names on the paper. The boss threw the matter up in disgust while my faith in the British mechanic was considerably shaken; it seemed as if they did not want to pay for their paper when they did not want the price stopping out of their wages.

UNAMBITIOUS MEN.

In my experience, the ordinary workmen of to-day, from the age of thirty upwards, know and care very little for what is going on in the world; they are quite content to go on in the same old way that they did when they first went to the trade, improved methods, foreign competition, labor-saving appliances, etc., being nothing to them; so that if, in conversation with them, you casually mention some of the results obtained with some machine or appliance which to you is quite familiar thru constant contact with it in the advertising columns of the engineering press, they regard you as a hopeless maniac, believing everything you hear and read. If they happen to know it is an American paper from which you got your information, they will tell you at once that American tales are not to be trusted, just as, I understand, the Americans call any tall yarn they hear, a Britisher.*

Just here I should like to say that, in my opinion, a lot of the indifference and apathy of the workmen of this country is due to this very thing, the idea being that any report from across the "pond" has to be well diluted before being believed, so that they cannot imagine what is really being done in the States.

THE YOUNGER GENERATION.

In contrast with the above, I think the coming generation of mechanics, say from fifteen to thirty years of age, are nearly all that can be desired. They work from 6 o'clock in the morning to 5.30 at night, then for nine months out of the twelve are engaged at night classes three or four nights a week, from 7 o'clock till 9; home lessons generally taking up the remainder of the week. Then some people begrudge them the hour and a half for football on a Saturday afternoon.

THE EMPLOYERS.

The employers (I think it is their turn now) are brightening up considerably, tho there is still plenty of room for improvement. One or two firms that I know have a long and honorable record for making a good machine tool, but they are content to rest on their laurels. They advertise very little, and don't seem to care whether orders come in or not. It is a fact that two of the oldest and best firms in this town are practically idle, while the younger firms and those who "push" their machines are fairly well stocked with orders. One of these latter firms has made gigantic strides during the last three years, introducing the limit gage and interchangeable systems, doing every possible operation with the aid of jigs, standardizing designs, etc. They have also introduced one or two negative improvements, like the following: If a man stops off his work, even to go to a funeral, he is discharged (this doesn't look much like attending mid-week football matches), and apprentices in the erecting department are kept from six to twelve months scraping up lathe beds; this will develop a poor specimen of bench hand, I should think.

THE SHOPS.

The shops, generally, are as convenient for engineering workshops as for anything else. Well lighted I have generally found them, but as for ventilation and heating, awful. When a piece of iron is touched in the cold, wintry mornings it reminds one of the burning sensation referred to by Arctic explorers when they touch metal in the polar regions. The men are walking about with their coat collars up—that is, when they come away from the blacksmith's fire. On the other hand, the atmosphere in summer is nearly at boiling point, an attempt being made at ventilation perhaps by putting wood blades on the line or other shafts to stir up the air. Of course these shops are run by men who think that a man is not worth his salt if he cannot work to keep himself warm.

The finest shop I have seen, up to date, is the turbine department of Messrs. Greenwood & Batley, of Leeds, where the De Laval steam turbine is made. In this shop the machine tools, about twenty in number, are driven by independent motors, which are built into the machines. The floor is of concrete, and the cleanliness and general orderliness of the shop, as a whole, make one wonder why firms will go on with their old shops where it is like being in a maze, threading one's way from one end of the shop to the other.

MACHINE TOOL DESIGN.

With regard to the designs of the machines, I think the American article is more refined, more finished, every little detail being studied and worked in to form a harmonious combination, the elaborate and intricate mechanisms incorporated in all American machine tools being all designed with the sole aim of simplifying the operation or increasing the production. I think the designs of English machine tool makers are all very well for the older class of machinists, but I think it is a good education to work on a good machine. The more complication there is—necessary complication of course—the better is the effect on the workman; he tries to follow the designer's line of thought, and eventually masters the whole of the mechanisms which he operates. English toolmakers have waked up considerably during the last three years, but American influence is to be traced in nearly all their designs. I have no doubt, however, that we in England have done more towards the design of high-speed machines and tool steels since the Paris Exhibition of 1900 than has been done in the States, and I think that this is a very good sign indeed.

To sum up, I think that if the British mechanic only full realizes the competition we have to meet from America, Germany, etc., there will be no fear about the results. It is to the AMERICAN MACHINIST that our gratitude should be given; it has been preaching for years, and only within the last year or two have the good results been shown. It is impossible for us to keep ahead, or even up with the race, if we do not know what our competitors are doing, and I have yet to find another enginering periodical devoted so closely to our work and showing us so well the world's progress in machine tool building. Perhaps some other of your readers will let off steam on this subject, which I think is of national importance.

PATRIOT.

*This is news to us—Ed.

Dimensions on Drawings.

I have read with interest Mr. Rowell's article at page 164 on the various methods of putting dimensions on drawings, and as I am at present engaged in an office where we get a large number of tracings, blueprints, etc., from other firms, I can fully appreciate his plea for a drawing office standard throughout the trade.

It is time something was done in this line. At the time of writing I have in front of me a blueprint from one of our large engineering firms with a dimension $1 - 3 + .54$, which I take to mean 15.54". I am sure that there is nothing that would give the workman more trouble than a dimension so stated, altho apparently simple to the man that put the figures down. On the same print there is a wheel with six ribs of gray iron; these ribs are figured .6875. But why not .7? I do not think the draftsman expected the patternmaker to work to a ten-thousandth. Needless to say our patternmaker's comment on this figure was far from complimentary to the draftsman.

Having gone so far, I will now proceed to offer some little suggestions, which would, if adopted by draftsmen generally,

add greatly to the appearance of a drawing and be a boon to the men that have to work from them: (1) Keep all the dimensions (as far as practicable) outside the piece concerned. (2) Where you are dealing with casting thicknesses, keep your figure to the nearest .05. (3) Dimension your drawing from the workman's point of view. (4) Where there is a limit to work to, let it be stated as $3.5^{+.1}_{-}$, it being understood that the limit is in thousandths of an inch. (5) When you have any note to put on a drawing, put it on in the plain block type. The various types of fancy printing doubtless look pretty, but they do not help the workman.

In conclusion, I say that if these suggestions were carried out by a few chief draftsmen it would do much toward standardizing our drawing-office methods. In writing this I write as a strong advocate of the decimal system, which system, altho not lending itself to subdivision as the fractional system, is by far the most convenient for small machine-tool work, in which work you cannot always keep to the fraction.

ALFRED LAWRENCE.

M., England.

A Five-Operation Punch and Die Job.

I send you sketches of a five-operation punch and die job of rather unusual character. Fig. 1 shows the blank, and Fig. 2 the finished piece. The piece was required to be very accurate in all dimensions; the curve also was very important, and it will be noticed, Fig. 2, that there are two distinct curves, one a little lower than the other. The stock was steel, .040 inch thick, bright drawn. The first operation was to blank and pierce, Fig. 1, which calls for no special comment, as the dies were of the ordinary built-up type and fitted to their own bolster plate (as were all the others), and could be ground up when worn. Great care had to be taken in sizing the blank, so as to save trouble during the following operations.

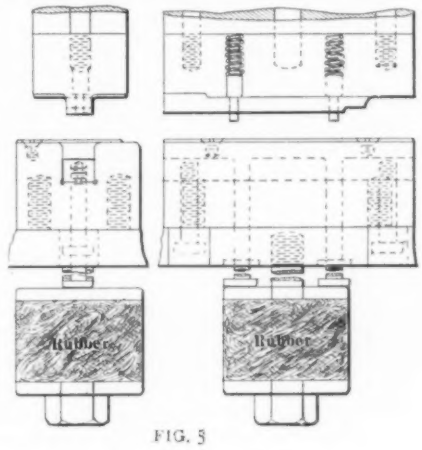


FIG. 5

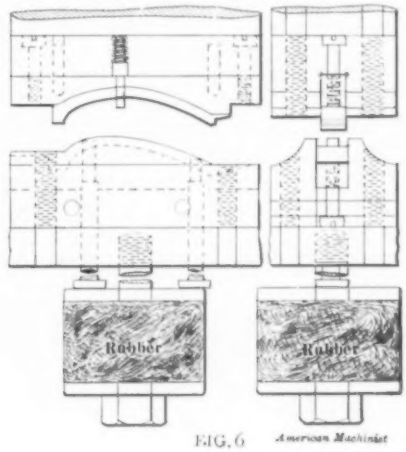


FIG. 6

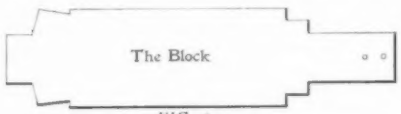


FIG. 1

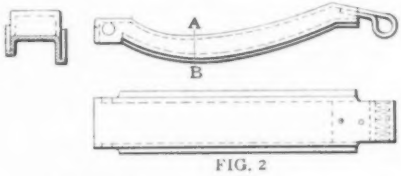


FIG. 2

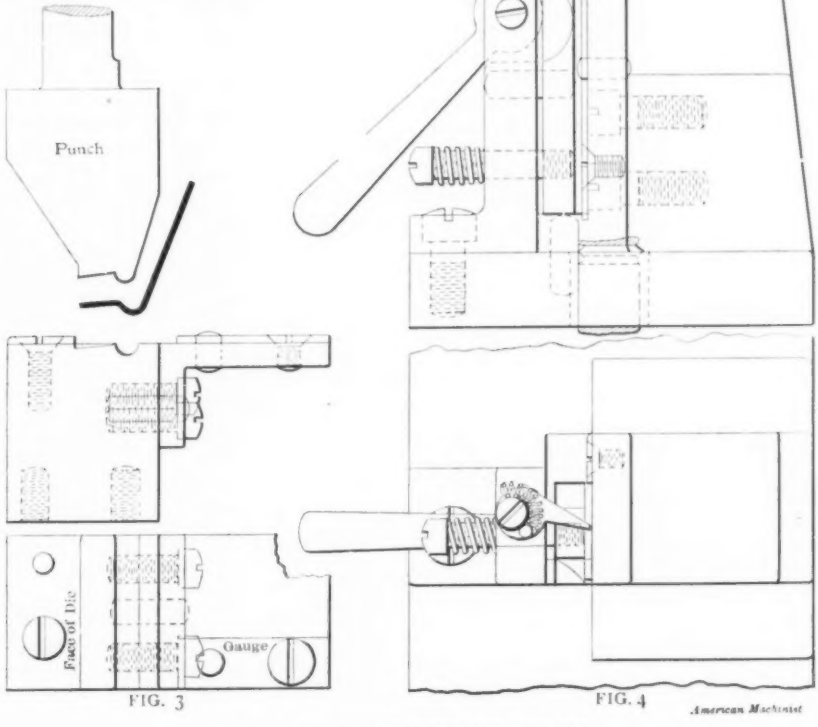


FIG. 3 FIG. 4

American Machinist

A FIVE-OPERATION PUNCH AND DIE JOB.

The second operation was to half curl the end of the blank, which was done in a small press with the punch and die as shown in Fig. 3, both doing good work.

The third operation was to finish the rounding of the end of the blank. This was done by placing the blank against the gage plate, Fig. 4, pushing the small spring lever back in doing so, then raising the lever and clamping the blank to the die face, the punch then descending and rolling the bend, the clamping plate being recessed to allow the end to roll over and also to keep the punch from pressing the blank forward; the lever was then pressed down and the trigger forced the blank out, as the bottom of the die was beveled to allow the blank to fall clear.

The fourth operation is bending the sides of the blank upward and slightly breaking the corners which are to be forced over, as the corners must be square and sharp. The gage plate is brought across the die, and the blank is steadied by the two spring pins in the punch. The blank, when pressed into the die and finished, is stripped by the lifting of the loose piece in the die, the lifting being done by the rubber pad below the bolster plate.

The fifth operation completes the piece by forming the long curve, closing over the end of the piece and making a small angle on the tapped bend. This die is made in sections so as to be easily ground and adjusted when wear takes place. The blank is shipped by means of the pins thru the die, which are worked by the rubber pad as in the fourth operation. These dies and punches did their work remarkably well and overcame all difficulties in what was, I think, a rather nice piece of punch and die work.

NOMAD.

Shop and Drawing Room Suggestions.

I have heard of readers patient enough to acquire and assort an extensive collection of clippings. These are filed away under the guidance of an index, so that the item and its source are within easy reach. There are a fortunate few in possession of a file of the AMERICAN MACHINIST, and possibly other papers complete, and this, too, is an admirable advantage. I have never carried out either of these plans as thoroughly as could be desired, and am just so much in arrears by trusting mainly to memory. There is another trouble about this technical misfit. I can sometimes say I have read something somewhere in the AMERICAN MACHINIST, and be at the same time in an uncomfortable position from sheer inability to prove by date and page the fact I assert. I may be wrong, anyway, because it is not any too rare a trick of memory to credit an extra good thing to the source whence we have had others.

FREE-HAND INKING.

Take the useful suggestions for drafting improvements at page 1744, Vol. 27. I have not seen the subject of free-hand inking discussed in these columns and anticipate a vigorous shaking of heads upon my assertion that many drawings could be inked free-hand much quicker than with instruments. I have a distinct recollection of a writer several years ago telling a tale of an immigrant draftsman acquaintance. He was helpless as a designer in that particular shop, and of course did not promise well. As a last resort he made tracings and was a conspicuous success, turning out work so rapidly that an inquiry was made and disclosed the startling fact that much of the work was free-hand. The work went on its merits, however, and set a pace. The artist draftsman gravitated later to a more promising position in the field of illustration. Prof. Sweet once gave instruction in sketching in these columns, illustrating the lesson by off-hand drawings of his measuring machine, and thus doing at least three things simultaneously. He exhibited the characteristics of a most interesting instrument, pointed the way to a profitable accomplishment and demonstrated the practical possibilities of free-hand work. I suppose, but cannot state positively, that the originals of his illustrations were inked in by the professor. The engraver may have worked from the pencil sketch, but in that case would almost certainly have spoiled the effective roughness of the examples. I prefer to think the former was the actual method until I am officially corrected. These instances convinced me that free-hand tracing can be employed with advantage, and to a much greater extent than it is at the present time.

A CHEAP WAY OF MAKING STUDS.

Habits die hard, and the innovator has a tough job when he falls afoul of shop tradition. I shall never forget the horrified look of one shop foreman. I had a lot of studs to make in a jobbing shop. They were wanted in a hurry, were made on the lathe in pairs, cut thru at the middle after threading, and the heads touched up a trifle—holding the shank in a chuck. The threaded shanks were to fit the regular—or irregular, according to your sense of accuracy—commercial nuts. We had a good set of dies and I roughed out the threads in the lathe and then ran the die over them for a finishing cut. This did not call for near so much grinding of thread tools and was a fair fit for the nuts. I was found out and sternly rebuked, but at too late a stage to delay the job. The work went with satisfaction, and I suppose that the studs did as good service as if they were all made in orthodox style on the lathe or in the speediest sort of screw machine. From this experience and many others I infer that new tricks are easier learned than taught.

DRAWING PENS.

The pen on page 1744, Vol. 27, is a new kink to me, tho I am familiar with what is a first cousin to it—the little pointed slide seen on some of the wide pens of German origin and used for round writing. I once saw a writing pen which had a straight piece of wire on the concave side, parallel with the shank and at a distance of, say, 1-32 inch apart. I suppose the device would work if on the convex side of the pen, after the Wirt fountain pen pattern. Probably this wire scheme would be in more common use were it not for the adoption of the fountain pen for general writing. The "Eternal" fluid of Higgins' breed is, I may say, readily workable in a fountain pen. To my thinking, the ordinary drawing pen is a humbug. I have seen it balk at the most inconvenient times, and then it compares with its immediate neighbor, the lead pencil, in time consumption. Certainly with fairly fluid ink and liberal width of lines a reasonable stock of care will avoid annoyance. Failure in any one of these brings on trouble galore. If we cannot apply the writing-pen (plus reservoir) principle to the ink distributors among drafting instruments, would it not be feasible to heavily gold plate the drawing pen points and tip them with iridium in gold-pen style? They would then clean easily, wear for a lifetime, and, figuring on gold-pen prices, the extra cost would be less than a couple of dollars. Would it be worth while?

LETTERING GAGES.

The lettering gages on page 1644, Vol. 27, remind me that a writer in these columns has given another suggestion to this end. He mentioned the use of thread gages to get the spaces. The average thread gage gives a variety of spacing to suit individual taste, but does not of course allow of sharpening to the extent of the form shown by Mr. Gribben. The whole question of lettering strikes me as capable of another answer; perhaps not altogether a complete solution of the problem, but, within certain limits, an expedient worth consideration. Assuredly I make no pretence at imitating in any manner the ornamental work found on some drawings, especially those designed for architectural purposes. I believe the majority of sketches and drawings for things mechanical require neatly plain letters and figures, and anything beyond this unmistakable stage is as purely gratuitous as a mirror finish on a lathe leg. Is it not practicable to insert these letters and similar entries on drawings with the aid of the typewriter? It may be necessary to get the help of a thicker ink than is common, but a fresh ribbon is heavy enough to print, as a rule. Anyway a demand for something of the sort would soon bring out a satisfactory ink. The book typewriter would be very convenient, but for that matter most machines have wide carriages, and the pencilled notes could thus be made permanent on the bond or tracing stock. I find a typewriter having large type convenient for lettering sketches, and it is rather strange that patent attorneys do not employ it in their work. The small and uniform size of Patent Office drawings would seem very favorable for the process, and, by the way, is there any more striking example of irregularity in lettering than that exhibited by the *Patent Office Gazette*?

R. INGHAM.

Casting on to Iron or Steel.

Some time ago a party starting to manufacture vises sent their patterns to a foundry, and with them were sent the pieces of steel which were to form the faces of the jaws and which were to be cast on to the jaws.

The castings when received looked nice and smooth; they finished clean; but the faces! Those pieces of steel would come off once in a while, and there was always the uncertainty of the thing. They were sent to another foundry, with about the same result, then to another one, then back to the first.

Meanwhile the first foundryman had been scratching his head and thinking the matter over. He never swore (foremen seldom do). "We have been gating them wrong. I'll make them!" he exclaimed. The patterns came back, and when the jaws were molded they were gated so that the melted iron should strike on or near the pieces of steel.

Thus the iron in the mold was hottest next the steel, and as the mold was filled the iron was constantly flowing near the steel and from that point was filling the mold. Thus when gated and poured in this way the face of the steel past which the hot metal flows first becomes hot, then

soft hot, then a trifle toward spongy or plastic, and by the time the mold is full, and a little has flowed out of the riser into a small basin cut in the cope, the gray iron is completely fused on to the steel, or *vice versa* if you wish it.

It must be understood that the metal when poured into the mold as above must be *hot*. If the metal is not hot, it is not fluid enough to flow on to and then off of the steel surface and to heat up and cut into the steel and make the face of it fuse and intimately unite with the molten iron.

Chaplets and many pieces of wrought iron or steel are tinned, and in the pouring the tin fluxes the piece on to the casting. In this way the iron may be poured slacker (cooler) and "lie to" the iron or steel and be fluxed on to it. But when the iron or steel is simply polished or ground, and is to be placed in a mold, and the gray iron is to not only lie to it but to adhere to it so the two may become one, I have never yet seen it done successfully in a light casting unless the metal was hot when poured.

If the casting is of considerable weight and is poured somewhat slack, it may remain in a fluid state in the mold long enough to soften the face of the steel or iron so that it will adhere. Much depends on the chemical properties of the steel or iron on to which the gray iron is to be cast. I have seen some steel that it seemed much harder to burn or fuse the gray iron on to than others.

Some years ago the manufacture of a certain chilled safe was undertaken. The parts of the safe varied in thickness, but the part I shall refer to was the back. While I do not remember the exact thickness I will call it 2¾ inches. The outside of this part was cast in a chill; the inside was made at first by a green-sand core and later by a dry-sand core (I will term it). Then some experiments were made which showed the need of a cage of wrought iron or steel inside of the gray-iron structure.

Accordingly a cage was made, of the size to bring it in the center of the casting, and so that there might be a certain amount of gray iron surrounding the iron cage in the center of the casting. This cage or grating was brought into the foundry, made of rolled iron or steel, I don't know which, and was not in any way polished, altho it was not rusty. A fire was made under it and an attempt was made to coat it with smoke or soot. The man told the apprentice boy it was being smoked to make the iron "lay" to it. At any rate all hands in the foundry were pretty well smoked out, there being lots of tears shed, but no grumbling, as it was an experiment. The cope was placed on the floor with channel-way for vent to escape, the cage was lowered over it and secured; the chill, which had been warmed, was lowered and keyed; the runner was built, etc. But the casting was not a success, as the hot iron did not lie quietly to the wrought-iron cage, and come up against the chill over it, and form the kind of casting wanted.

On breaking up the casting, it was found that the iron, being poured at the requisite temperature to produce the required chill on the casting, did not fuse on to or adhere to this cage.

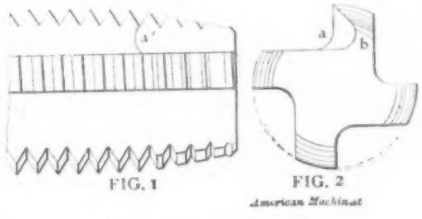
The next experiment was giving the cage a coating of red lead, the lead being such as used by steam fitters or pipers, dry red lead mixed with naphtha, the naphtha evaporating and leaving the cage coated with the lead. While this experiment was more successful than the first, yet it did not fill the bill.

The next experiment was, giving the cage a tin bath, and the trouble was at an end. The molten metal lay to the cage, and the casting came out satisfactorily. While many things have been used on wrought iron and steel as coatings to cause the molten iron to adhere to them, my own experience has been that next to tinning the wrought iron or steel, the best way is to give it a coat of liquid glass, and it will not take many trials to convince the most skeptical. The man pouring the iron, or having it poured in vise molds, must watch his chances and pick his iron if his furnace does not run sharp iron all the time.

R. H. PALMER.

Taps for Steel Nuts.

My experience in threading machinery steel with taps and dies does not accord with Mr. Allan Winter's recommendations



TAPS FOR STEEL NUTS.

as regards rake. His Fig. 1 at page 227 is a familiar illustration of the consequences of using dull taps, or "nut busters," as they are sometimes called. It is occasionally an advantage—when tapping woolly steel, for instance—to give the leading teeth considerable rake, as shown somewhat exaggerated at *a* in Fig. 2 herewith, as far up the tap as *a'* in Fig. 1. To give the full teeth the rake that Mr. Winters recommends is to make needle points of them, which are easily broken and are more difficult to temper. Then, too, the flute weakens the metal at *b*, Fig. 2, and allows the teeth to spring out into the work if it is heavy. I have found it to be necessary to keep taps and dies sharp, and ground so that each tooth shall do its share of the work, with the starting taper slow enough, so that the teeth successively shall not have more metal than they can comfortably cut, and room in the flutes to keep the chips from choking when working open-hearth steel. AMOS PRICE.

Holding Work on the Live Center.

The various ways of holding steady-rest work on the live center that are coming to the front just now prompt me to state the following simple method.

In the course of my work I have made many pieces which would have been impossible to hold by the methods recently contributed. For instance, I have to make cast-steel pieces 8 inches long, with 6 inches of that length in the form of a tapering shell, .018 inch thick. This shell is .01 inch larger at the back end, and is made in such a variety of sizes that the diameter of the hole may be anything from ¾ to 3½ inches, by thousandths of an inch or millimeters. It is essential that the hole be dead true. It is finished out by boring and grinding to size when held in the steady-rest, the steel being less than 1-16 inch thick then, and subsequently turned down to size on special arbors. Frequently it becomes necessary to re-steady-rest them, and the results would certainly prove disastrous to anything so thin if the attempt were made to apply any apparatus requiring the tightening of bolts or nuts.

To hold such work back to the center I use a rope, which would be tabooed in many shops, I know; but we of this grand old commonwealth still believe in the use of a rope as a last resort.

A hard woven cord, about 3-16 inch diameter, is looped over the set-screws of the dog, the ends carried thru the slot in the face-plate, down around the back of the face-plate, out thru the other slot and then tied over the dog's rump, where his tail grows on—or off. Two slightly tapering wood wedges, of oval cross section are pushed with the fingers between the face-plate and the cords where the latter come thru the slots, thereby giving the cord any degree of tension you wish and holding the work to the center with all the force required and with the strains equalized.

This tieing-up process is much more rapid than the telling, and I believe can be applied more quickly than any form of bolt or strap arrangement. It is very efficient upon light or heavy work; the woven cord does not stretch perceptibly, wears well, and the materials are always available and very inexpensive.

In case the nature of the work is such that it will not warrant the use of a dog, a few turns or half hitches of a cord upon the work and back to the face-plate will act as a driver and at the same time retain the work upon the center.

I have had occasions when the only practical solution of holding the work to the center was by means of solder, which is easily applied and as easily removed.

GEO. W. ARMSTRONG.

Accuracy in Slide-Rule Operations.

Every slide-rule owner wonders that the slide-rule has not come into more general use. The reason frequently given is that it is too difficult to learn; that many who attempt its use give up before they come to appreciate its utility. There is a shade of truth here.

A more reasonable explanation is that the slide-rule has the reputation—a just one, but one too often enlarged upon—of reaching only approximate results. The slide-rule, however, is not used as much as it should be. Nor is it generally manipulated so as to bring as accurate results as it is capable of doing. This latter somewhat unfortunate fact has been the basis of some thought on the part of the writer: the results may be interesting and of service.

Firstly, considerable skill can be acquired in reading values between those indicated by the regular divisions if the operator will familiarize himself with the exact locations of these unmarked points. This method of their determination is useful: Place 1 (lower scale) of slide over 101 of scale "D," then 5 will be directly over 505, a division point; 4 will be over 404, 6 over 606, 8 over 808, etc.

Secondly, the rider, which is generally used only to retain a given point while the slide itself is being adjusted and to assist in finding powers and roots, may be made very useful in approximating third and fourth figures more closely than the eye alone can. Suppose a number between 40 and 41 (lower scale) is to be a multiplicand. If the rider is brought to 40.25, being practically midway between 40 and 40.5, and then the end of the slide is brought to the point midway between the rider line and 40, its position will be 40.125 correct to four figures.

If slide and rider are so adjusted as to divide into thirds this division from 40 to 40.5, the slide will be at either 40.166 or 40.333. By locating the slide at the last quarter we get 40.375.

For any number, then, between 40 and 41, after having made mental note of these values, 125, 166, 333, etc. (values similarly useful over the whole rule), place the slide by aid of the rider at the nearest value and approximate only for the difference between this and the desired value. The utility of the rider in reading results and in performing the numerous other operations possible with the slide-rule will be readily recognized.

The last suggestion is rather in the nature of a problem, of which there is a partial solution below, viz., that of applying the vernier principle to the slide-rule. This is readily done between 1005 and 1010, and a similar tho less simple law applies over a considerable portion of the rule. Between 1005 and 1010 the reciprocal of the last figure represents the number on the slide which must exactly coincide with the nearest division on the rule to bring the desired number under the end of the slide. Take 1008. The reciprocal of 8 is 125. 125 : 126 = 1 : 1.008, as is readily shown by dividing. For 1006, 166 and 167 should coincide with 167 and 168, etc. Whether there is any simple law holding or whether a rule could be constructed to take advantage of the vernier principle, cannot be said; perhaps neither is feasible. But certain it is that the field for thought here is a rich one, one in which the thinker will be well paid in a better practical understanding of the instrument even tho he should be compelled to give up the hope of discovering means whereby a small rule could be made as accurate as present large ones.

GEO. MAIN.

"A Vanishing Thread on a Cone."

When the Brooklyn Bridge was being built I was running a small machine shop in Brooklyn having the big name of The Brady Manufacturing Company, the name being the only big thing about it. I secured the contract for furnishing the couplings (about 200,000) required in connecting the wires for the bridge cables. The state of the art at that date limited the lengths of the wire used to about 600 feet, while now I believe it can be made in lengths of 3,000 feet. These wires were made practically continuous by the use of the couplings.

Fig. 1 shows the peculiar construction of these couplings. The threads were of course right and left and the abutting ends of the wires were cut obliquely so that they interlocked as shown when drawn together, the object of this interlocking being to prevent uncoupling by unscrewing while being laid into the cables, as often had occurred before this plan was adopted. Fig. 1 shows also the form of thread used, technically known as a vanishing thread.

A party had sued the cities of New York and Brooklyn for infringing his patent by the use of this so-called "vanishing thread on a cone," and employed me to design and make such models as I thought necessary to use in court to show what constituted a "vanishing thread on a cone," as claimed in the patent. I designed and furnished what I considered essential in the way of models, consisting of a threaded end of wire, having the vanishing form of thread on a cone, see Fig. 2, and a portion or section of a coupling to receive the same. These models were very much larger than the size of the wire, which was, as I remember, No. 7. My models were about 3 inches in diameter of "wire" and were so made that the so-called vanishing thread could be removed from the cone and replaced at will. This thread was of the V form, or practically an equilateral triangle in section, being at the small end of the cone the full size of the standard pitch used, and tapering its entire length to a vanishing point at the other end. My object in making the thread removable from the cone was to be able to show conclusively that the thread in itself *was* vanishing in form, and that in practical use it must be used on a cone.

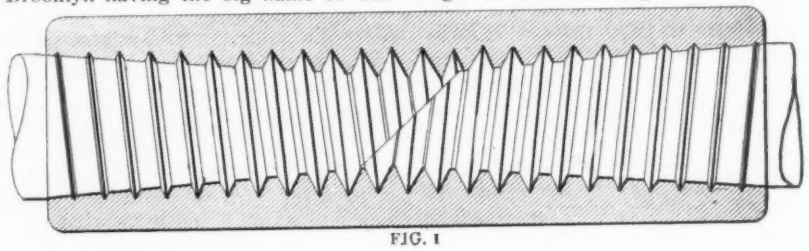


FIG. 1

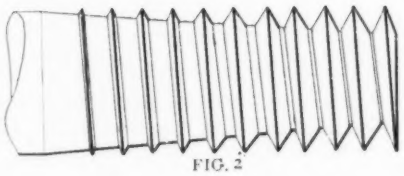


FIG. 2

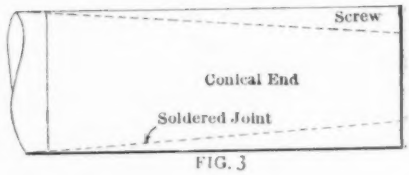


FIG. 3

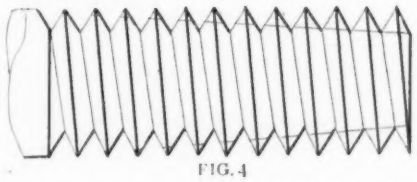


FIG. 4

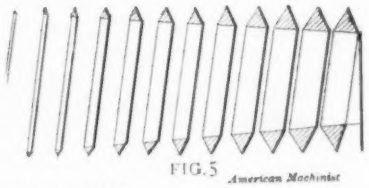


FIG. 5

American Machinist

A VANISHING THREAD ON A CONE.

It seemed to puzzle those who saw these models in court and elsewhere to determine how the removable vanishing thread could be so perfectly made. We made two conical ends alike, representing the bases of the threads on the threaded ends of the wire (enlarged). We also made a sleeve having a taper hole to perfectly fit the entire length of the cone, its outside diameter being the same as that of the wire, and soldered the same on one of the cones, Fig. 3, by the process known as sweating, leaving as little solder in the joint and elsewhere as possible. We then, using a lathe, cut a

full straight thread of the desired standard pitch the entire length of the sleeve, the cutting reaching thru the sleeve into the cone, as shown by Fig. 4, and then unsoldered and removed from the cone, all that remained of the sleeve which, when the solder was carefully removed, was the desired removable vanishing thread, Fig. 5. This removable thread of course fitted perfectly on the remaining cone, see Fig. 2, and when in that position also fitted as perfectly in the threaded portion of the coupling.

The taper of the cone or the difference between the large and the small diameters was equal to twice the depth of the thread, so that the couplings could be tapped out with a straight tap. The making of the coupling model was a simple matter and needs no explanation.

Perhaps it may be of interest to some of your readers to know that the wire used in the bridge cables was spring temper, and that by the use of the vanishing thread above described the tensile tests showed that none of the couplings failed to give at least 95 per cent. of the full strength of the wire and, as a whole, they averaged higher; also that the cutting of the threads on this spring tempered wire called for a special construction of dies, the standard make proving an absolute failure. The models were made from bronze castings cored out for lightness and convenience in handling. JAMES BRADY.

Brooklyn, N. Y.

Micrometers and Decimals.

The other day I had occasion to give an order to a machine shop about as follows:

Make two steel plugs, one ½ inch and one ¼ inch diameter, each 5 inches long. Fit each plug into a hole in a casting (sketch given), making as perfect an oil sliding fit as possible. (Plug and gage fit.) The sketch showed each casting to be a cylinder 6 inches high, 1⅛ inches diameter, resting on a base 5 inches diameter and ¼ inch thick, and that a hole was to be bored and tapped into it for a ¼-inch pipe.

The machinist did a good job. He used a micrometer caliper capable of reading to .0001 inch when he was grinding the plugs to the size given. He had no inside calipers with which to measure the diameter of the holes, but they were probably .0001 or .0002 inch larger than the plugs, and a satisfactory fit.

Since the job was done I have read your editorial at page 262, the last paragraph of which says: "One of the most awkward and expensive things connected with American machine shops to-day is the fact that we use a mixture of common and decimal divisions of the inch and are constantly spending time and energy in translating from one to the other. We use the former because we have inherited them from a time of relative crudity and bygone conditions."

It is possible that the reason I used the dimensions ½ inch, ¼ inch, 1⅛ inches, 6 inches, etc., in the order I gave to the machine shop was because I had inherited them from a time of relative crudity, but it seems to me that while this is true, these dimensions are in customary use in the most refined machine shops to-day thru the operation of the law of "the survival of the fittest." All of the dimensions of the casting were expressed in the simplest and easiest terms in use. Even the dimensions ½ inch and ¼ inch are just as "modern, systematic and refined" as the corresponding dimensions .500 and .250. The machinist of course used the decimal dimensions when he used the micrometer screw gage, but the amount of "time and energy spent in translating from one to the other" was infinitesimal. Of this fact the writer of the editorial himself seems to be well aware, for in the paragraph preceding the one quoted he writes: "The writer hereof knows by personal experience that everyday use of the micrometer caliper with a table of decimal equivalents soon enables one to translate mentally from thirty-seconds, sixty-fourths, etc., to thousandths, and *vice versa*."

This is a perfectly correct statement, but it does not harmonize with the statement that the mixture of common and decimal divisions of the inch is one of the most awkward and expensive things connected with American shops to-day.

Is it not a little curious that the editor of the AMERICAN MACHINIST should protest against the use in the machine shop of two methods of subdividing the English inch and say that "the less the two are mixed the better for all of us," and only a short time ago the paper was advocating the introduction into the machine shops of a still worse mixture, namely, the mixture of English and French systems of measurement? WM. KENT.

Syracuse, N. Y.

[The above letter of Prof. Kent's is, we think, something of a curiosity in its way. First let us say that, so far as the letter gives us any evidence upon the matter, Prof. Kent has not the remotest idea of what actually took place when the machinist made the fits referred to. It is extremely rare in such cases for the entering piece to be made a certain definite diameter and then the hole made to fit it by repeated cuts. Of course if the job required that those plugs should be precisely the diameters stated, and that the holes should then be made a tenth of a thousandth larger for the fit, it could be done, but it is a very difficult thing to do, and unless Prof. Kent stood by and saw it done, we should be inclined to doubt its having been done that way. And even if it was actually done in the way described, it proves nothing against our remarks, because cylindrical fits are seldom made in that way, and our remarks were based upon regular and usual machine shop practise, in which practise the custom is always to bore, ream, grind or otherwise finish the hole to the required size (usually as near some standard as convenient, but with a definite allowance expressed decimally), and then to make the fit by adapting the size of the entering piece. Of course any method whatever may be followed in a college shop, and sometimes very irregular ones are followed in other shops, but the method followed in shops pretending to do things systematically, nowadays, is to call both a hole and its shaft, say, 1 inch diameter if you please, but to make neither exactly that diameter except by accident. That is to say, the reamer *may* make the hole exactly 1 inch once in a while, but usually somewhat more than 1 inch, while the shaft will always be below 1 inch, and the amount below that will be allowed will be stated decimally. These are simple facts, familiar to all shop men, and there is no use in college professors nor anybody else quarreling with them. This being the case, we think our opinion, to the effect that the limiting or actual size of a shaft should be stated in straight decimals (as, for instance, .8095 instead of such an abominable mixture as 13-16 — .003) is a perfectly proper opinion to hold, tho of course others may hold a different one if they choose. Facility in translating from common to decimal divisions of the inch, tho usually acquired by those who are constantly using the micrometer, usually costs a good deal in its acquirement, and a good many draftsmen, foremen and workmen who have more or less of it to do, do not attain proficiency in it. That is why the necessity for doing it is expensive to American machinery builders and we think the desirability of avoiding the use of mixtures of common and decimal divisions is self-evident. The last paragraph of Prof. Kent's letter is perhaps based upon the assumption that the AMERICAN MACHINIST has advocated the adoption (perhaps the forcible adoption) of the metric system in American machine shops. If so it is a wrong assumption. We have expressed our belief that if the government should so legislate as to become a buyer of machinery and other things made more or less in accordance with the metric system, there would be no harm in that, and might be some good. As to the use of the system on other than government work we have deprecated legislative interference, and have stated our belief that the system would make headway in machine shops only by steps in that direction taken by individual manufacturers, which steps would always be taken because they were commercially advantageous steps to take, as indeed they have been taken by a number of manufacturers here and in England.

The editorial article referred to is simply a plea for systematic procedure in measurements made in machine shops. It

speaks for itself, and will we think, be condemned by very few shop men. It is not an argument for the metric system, and the mixture of measurements referred to is an entirely different thing from that which results from the use of metric and English systems of measurement in the same shop.—Ed.]

The New Cunarder "Coronia."

The Cunard Line received about two hundred representatives of the press on board its latest ship, the "Coronia," on March 8. The ship, the luncheon, the attention to the visitors, were typical of the Cunard Line's reputation for hospitality. We leave the description of the sumptuous fittings of the "Coronia" to the daily papers.

The "Coronia" is 675 feet long, 72 feet 6 inches beam, and 97 feet in depth from the bridge to the keel, her loaded displacement about 30,000 tons. There are four classes of passengers carried. Her capacity for all classes is 3,100. Her crew consists of 400 men and women.

The "Coronia" has twin screws, one right- and one left-hand, of manganese bronze, 21 feet diameter, 25 feet 6 inches pitch, with four blades. Each screw is driven by a quadruple-expansion engine of the Yarrow-Schlick-Tweedie type. The cylinders are 39, 54½, 77 and 110 inches diameter, with a stroke of 5 feet 6 inches; working speed, 90 revolutions per minute. The two engines are in one large room, there being no fore-and-aft bulkhead between them. Their combined indicated horse-power is 21,000. The pistons are of cast steel. Wherever possible the parts, such as connecting rods, cranks, etc., have been made duplicates, and the engines are in perfect balance. Piston valves are used for the high-pressure cylinders, the mean-pressure and low-pressure having double-ported balanced slide vales.

There are eight double-ended Scotch boilers with three furnaces in each end and five single-ended with three furnaces each—sixty-three furnaces in all. The boiler pressure is 200 pounds. Howden's system of forced draft is used, air pressure in ash-pits ¾ inch water.

The bunker capacity is about 4,000 tons. The coal consumption per twenty-four hours is about 250 tons.

There are about seventy-five auxiliary engines for electric lighting, cooking and heating, pumping, handling cargo, etc. Steam to these is supplied at a pressure of 150 pounds. The main shafts are 22½ inches diameter. The couplings are 38 inches diameter. The thrust collars are thirty-five in number for each engine. The engines are equipped with Aspinall's governor.

The air pumps are of the lever pattern. The circulating pumps are centrifugal. The condenser tubes are tinned inside and out. The feed is by Weir's pumps. The evaporators are also by Weir and have a capacity of 80 tons of water for feed make up per twenty-four hours.

There is a workshop well equipped with machine tools. An ample supply of spare parts is on board, such as pistons, valves, connecting rods, crank and propeller shafts, half set of propeller blades, etc.

The guaranteed speed of the "Coronia" is 18 knots with 29 feet draft on an even keel. On the trial trip a speed of 19.62 knots was attained and maintained for about twelve hours.

The "Coronia" is shortly to be followed by the "Carmania," a triple-screw turbine-driven ship, and in 1907 two turbine ships will follow which are expected to make over 25 knots per hour. With this equipment and the reputation of never having lost a passenger—which it has so far enjoyed—the Cunard Line will stand in a class of its own.

Some time ago we suggested that some investigation be made regarding the matter of the finding of water by the so-called divining rod, and noted also that the *Times* of London had made the same suggestion. Since that time there has been placed in our hands a part of the proceedings of the Society for Psychical Research. This is Part 32, Vol. 13, July 1897, and it it will be found a very carefully prepared array of evidence on this subject, arranged and discussed by Prof. W. F. Barrett. Those interested can probably obtain this by addressing the publishers, Paul, Trench, Truebner & Co., Ltd., Charing Cross Road, W. C., London. The price when issued was 3s. 6d.

The Connection of Motors to Machine Tools at the Works of the Nordberg Manufacturing Company.

EDITORIAL CORRESPONDENCE.

At page 929, Vol. 25, will be found an account of the then new installation of electric driving at the Nordberg works, and as part of it are several illustrations of methods that were under trial for connecting motors to existing machine tools. These have now been in use long enough for their relative merits to be learned, and the accompanying illustrations show examples of the survival of the fittest, the method here shown having been adopted not only for converting old tools, but for application to new ones. Scores of examples of this method are now to be seen in these works, representing all classes of tools which were originally driven by cone pulleys—tools which, at the time the above mentioned article was written, were fitted with other methods of driving, having now been converted to this. The Nordberg Company has had large experience in this matter, and its conclusions are of corresponding value. It should be said that these works are fitted with the Bullock multiple-voltage system, and it is essential that to use this method the motor speeds have a range equal to that given by the cone pulley. In some of their tools the cone pulley range is, in fact, exceeded by the motors, leading to an overlapping of speeds, an arrangement which would not be provided in an original layout, but which has no disadvantageous features.

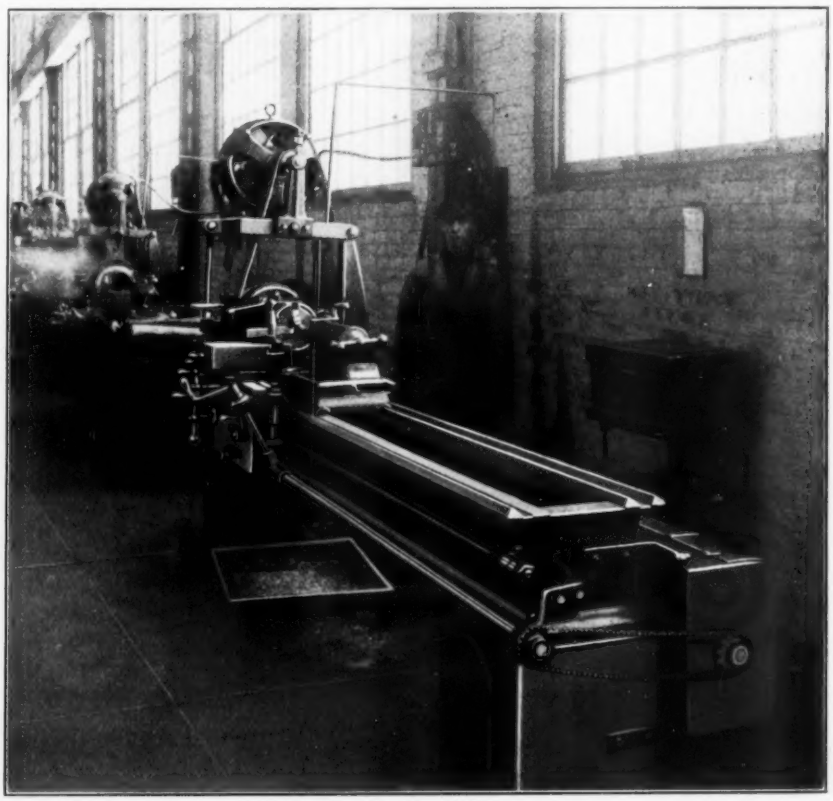


FIG. I. A CONVERTED LATHE.

Fig. 1 shows a converted lathe, in fact a reconverted lathe, as this machine happens to be one to which another method was originally applied. Two uprights will be seen to be bolted to the rear of the headstock, to the upper end of which is swiveled a horizontal platform on which the motor is mounted. From the front edge of this platform a screw support descends, the nut of which is supported by a bracket attached to the front side of the headstock, and which has a hand wheel attached to it by which the tension on the belt is adjusted. The motor is belted to the largest step of the cone pulley, the original pulley surface having been, however, turned off and a ring materially wider than the old step shrunk on and then turned up to provide a new belt surface sufficiently wide for modern cuts. The belt used is light double. It will be seen that slack of the belt due to stretching can be instantly taken up and that extra tension can be applied for extra heavy cuts.

The mounting of the controller will also be seen to be extremely neat. It is turned upon its side and attached to the back side of the extreme tailstock end of the lathe shears where it is out of the way—harm's way included—sprockets and a chain connecting it with a splined rod which has been added to the front of the lathe and which is actuated by a crank fitted with a dial and attached to the carriage. The lathe, altho a converted one, has thus all the convenience of speed control at the carriage that is provided in constructions which are new outright.

Figs. 2 and 3 show two additional applications of this method to boring mills, the drive in the two cases being at right angles to one another. In Fig. 3 the cone pulley is retained, altho but a single pair of steps is used. The location of the controller in this case will be seen to place it out of the way, while the controller hand-wheel is located adjacent to the levers which manipulate the gearing. The location of the controller hand-wheel in Fig. 2 is equally convenient—its shaft being seen thru an opening in the housing.

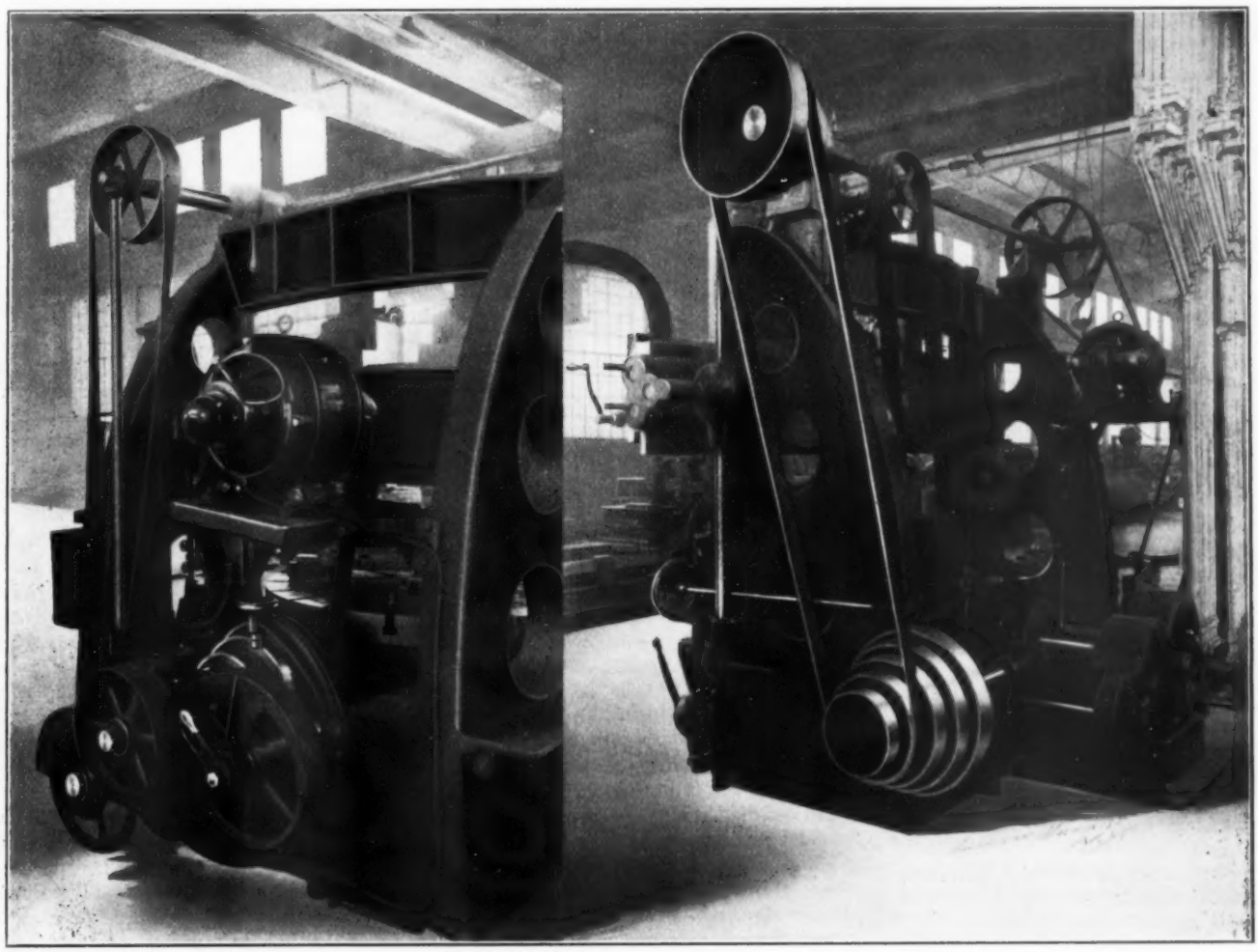


FIG. 2. CONVERTED BORING MILLS. FIG. 3.

Additional applications of this method to milling machines and to horizontal spindle boring machines will be found in the article above referred to.

The connection of motors to machine tools formed the subject of a discussion at a recent meeting of the Milwaukee branch of the American Society of Mechanical Engineers. Mr. Scholtka, superintendent of the Nordberg works, described his method which was criticised by a member of "advanced" ideas present, who said that it seemed time that a piece of cow as a part of a modern machine tool be abandoned. To this Mr. Scholtka retorted by asking, "What is a rawhide pinion but a piece of pig?" The belt in fact performs a very useful function which a rawhide pinion does not—that of the fuse box or of the circuit breaker. The fact that under excessive or accidental overload a motor will not stall but piles up its torque until it or something else has been destroyed, makes a safety device of some kind a necessity, and a belt would seem to be the simplest of all devices for this purpose.

In most cases, of which Fig. 1 is an example, it has been considered advisable to add an outboard bearing to the motor shaft, the bearing being supported by a bracket bolted to the motor platform.

F. A. H.

Henry M. Towne gave on February 24 an address before the faculty and students of Purdue University. His subject was "Industrial Engineering." The university has also announced lectures at an early date by William Barclay Parsons and Frederick A. C. Perrine; the subjects of the latter lectures not having been announced.

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The Layout and Construction of Cams.

Our readers will not fail to note the remarkably instructive articles on cams by Charles F. Smith of the Garvin Machine Company of this city, of which we publish the first installment on another page.

The author has been connected with the construction of machinery involving the use of cams for the past twenty-five years, during fifteen of which he has made the design of such machinery a specialty. As a result of this extended experience he has developed a line of procedure for the design and construction of cams which is entirely original and in the highest degree successful. He has designed machines containing as many as twenty cams and his experience is uniformly that given in connection with the chain-making machine illustrated in his article. The cams are laid out on paper and constructed and keyseated from the drawings and when assembled they perform their work in entire harmony and without filing, doctoring or changing.

Such results need no comment and we count it as particularly fortunate that instead of assuming hypothetical cases Mr. Smith has taken as illustrations of his methods actual cams from this machine. Of course, no single machine exhausts all the varieties of cams and, after showing how the cams of the chain machine were laid out and made, the articles will take up other varieties of cams which are not included in it. These will, however, be drawn from his fund of experience and thus in no sense represent hypothetical cases.

The stamp of the experience of the master hand is to be seen all thru the first installment of the article, and this will be equally evident in those to follow. The articles will explain the entire process, beginning with the preliminary charting and following thru the determination of the form of the cam grooves and their transfer from the drawings to the finished cams and will be illustrated not only with reproductions of the drawings, but with half-tones from photographs of the cam-milling machines. They will thus, we believe, fill, and fill well, a gap in machine shop literature which has long waited to be filled. We do not know of any other source from which the information given in Mr. Smith's articles can be obtained.

We may say that we have been on the lookout for someone to write such a series of articles for some years, and we do not think that a better pen could have been found than Mr. Smith's. In work of this kind, of which technical literature is practically silent, and in which the methods of each worker are largely the results of personal experience, it is not to be expected that the methods of different workers will be alike, and we wish to extend a pressing invitation, in which Mr. Smith joins, to all experienced workers in cams to contribute their experience and point out methods which differ from those followed by him.

Strong Cars and Weaker Cars in Collisions.

A rear-end collision which occurred in the new Subway in New York city brings out some of the old comments that have often been made in cases where colliding trains have been composed of some cars very much stronger and better able to resist telescoping than other cars in the same train, but which comments are, we believe, based upon a considerable misapprehension of what actually takes place when two trains come together. In the case specifically referred to, the last car of the first train was of steel, and the first car of the second train was also of steel. Thus the two cars which actually struck together at the moment of collision were of steel, while other cars in the trains were of wood and were telescoped, all the injuries to passengers occurring in the wooden cars. It is therefore assumed by an editorial writer, who expresses his views in the New York *Times*, and it probably will be assumed by a good many other editorial writers, that the remedy for this thing, and the obvious way of protecting passengers from the effects of collisions, is to make all cars of steel. The same thing has been pointed out with respect to Pullman cars, because they are stronger and heavier, and in case of collision the passengers in them are comparatively little injured. The fact is, however, that conclusions regarding this matter cannot be very safely drawn until experiments have been made with trains consisting entirely of Pullman cars or entirely of steel cars. The fact is that the intensity of the pressure or force developed by a blow depends very much upon the distance or time within which the force of the blow is absorbed. If it were conceivable that two trains could come together, strike, and be instantly stopped—*i. e.*, stopped within a time of 0—the force developed would be infinite, and no car could be made which would withstand it. It is clear from this that when two steel cars, or two Pullman cars, come together, and there are weaker cars in the same train, those weaker cars act as cushions or buffers and their telescoping or crushing, or other form of destruction simply relieves the pressure which would otherwise be brought upon the stronger cars, and much the same effect would be produced, probably, so far as injuries to passengers are concerned, if the strength of all the cars in both trains were considerably reduced, so long as such reduction was made proportionately on all the cars of the train, so that some of them would still be considerably weaker than others.

In view of the above, it is readily seen that those who ride in Pullman cars are made secure from the effect of collisions at the expense of, or by the imposition of additional risk upon those who ride in the weaker cars; because it is morally certain that when a collision occurs it will be the weaker cars only which will be telescoped or crushed; whereas if all the cars of the train were Pullmans of equal strength, it is likely that some Pullmans would be telescoped or crushed, and a different class of passengers would therefore feel the full effect of the collision.

It is altogether probable that if, in every train, there were vehicles of some form designed to telescope or collapse, and in so doing to offer a gradually increasing resistance, very few passengers would be seriously injured in collisions, unless they rode in the cars referred to. Of course the argument in favor of making day coaches as strong as Pullmans holds good, and they should be so made, but let no one think that those who might ride in such strengthened day coaches would be as nearly exempt from the effects of collisions as Pullman passengers usually are now, for the safety of the latter under present conditions is not due to one thing only—i. *e.*, to the strong cars in which they ride—but to two things, the one mentioned and the other the weaker cars that other people ride in.

Our Standard of Length.

Our attention has been called to the fact that when we said (page 306) that "the use of the meter bar as a final reference standard for length was authorized by act of Congress passed in 1893" we were in error so far as the act of Congress was concerned. It was, however, adopted as such final reference standard in that year by an order issued under the authority of the Treasury Department and presumably at the instance of T. C. Mendenhall, who was at that time Superintendent of Weights and Measures. The meter bar was therefore adopted as a final reference standard by an executive order, instead of by a distinct act of Congress, such order having been issued under authority bestowed by Congress and the difference, so far as we can see, being about equal to the difference between tweedle dee and tweedle dum. It is of course to be understood that such adoption did not involve any change of our standard of length, but that it simply constituted the metric bar which had been made at the International Bureau of Standards, the final reference from which our yard is derived in place of the previously used yard bars which had been made of material and graduated in a manner much inferior to the material and workmanship of the meter bar—so much inferior that results of different measurements or comparisons of the older bars showed very perceptible discrepancies. The adoption of the International Bureau of Standards bar was based upon purely mechanical considerations; much the same as might cause a machinist having a very accurate metric lead screw and an inaccurate English-inch screw to prefer the former for cutting accurate English-inch screws by using the proper "translating gears."

Should Engineers Interest Themselves in Sociology?

Among the questions to be discussed, according to the program of the Western Society of Engineers, is the one which we quote above. As to the propriety of an engineering society discussing this question, we have little to say. Of course any engineering society may discuss a question supposed to be of general interest to engineers. But we should imagine that the question of whether a given engineer should interest himself in sociology or not is one to be settled by the engineer himself. Some of us are naturally interested in things outside our business or profession; some in one thing and some in another. Naturally, the effect of the engineer's work and what he can observe as a result of the work of himself and other engineers leads him, if inclined that way, to consider questions of sociology, and those who have an interest in the welfare of their fellowman will naturally give some attention to it. We think that the engineer is perhaps more bound by considerations of humanity to consider such things than is any other member of society, because his work produces such a profound result upon the manner of life of the majority of people living under modern conditions. But there are some engineers whose taste does not incline them that way, and who would find little benefit to themselves and confer little upon others by interesting themselves in such questions. Each individual should, it seems to us, decide this thing for himself, whether he be an engineer or not. Aside from being engineers, or mechanics, or authors, or doctors, or lawyers, or merchants, we are all citizens of a common country with a common destiny, and with allied interests. This may well lead those inclined that way to the consideration of social and public questions, and we are glad to say that many American citizens yield to this impulse—engineers among them.

One thing in this connection which we particularly deprecate is the tendency to despise the efforts of those who honestly try to solve public questions and to bring about an improvement in social conditions. Plenty of men may be excusable for being "too busy" to give time and attention to matters of public interest. But the fact that they are too busy is nothing to be proud of. They should speak of it with genuine regret; not as tho it were a mark of superiority. The busiest and the best men have taken time to study such matters, and all the great progressive movements recorded in history—movements which have resulted in increased human liberty and improvement in the condition of the human race—have resulted from the fact that able men were impelled and were willing to give attention to public questions. We hear a good deal these days about the men who "do things." But before men "do things" that are right and that ought to be done there must be a lot of sincere, earnest thinking and of teaching.

As to Contributed Articles.

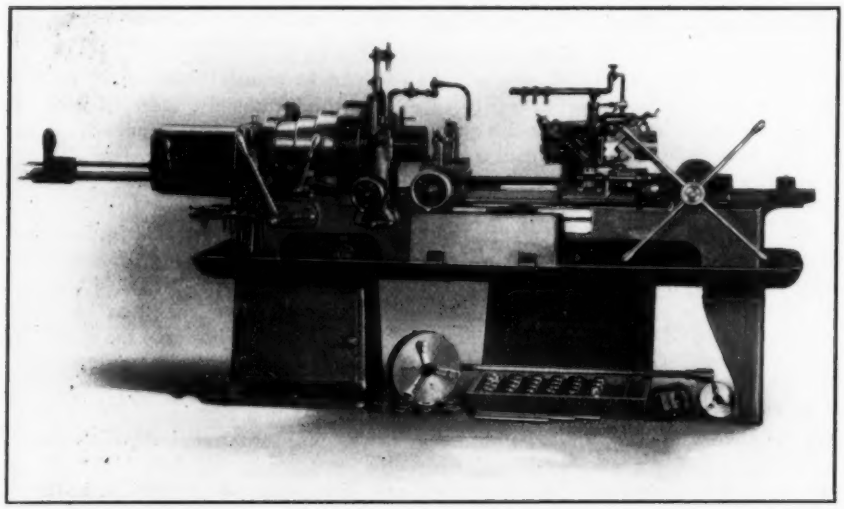
We think, possibly, there is some misunderstanding in the minds of a good many of our readers regarding the exact basis upon which contributed articles, especially "Letters to the Editor," rest. It is not to be understood that in the opinion of the editors every one of these letters describes the very best thing in its way, or a thing which is expected to be entirely new to everyone who reads the paper. The fact is that certain devices or methods of doing machine-shop work which are quite well known in a certain district or part of the country are practically unknown in other parts of it, and there is for this reason, if no other, often full justification for the publication of a letter describing a device which, as a matter of fact, may have been used in some shops for many years. Again, it frequently happens that a letter received describes a method of doing work which the editor who handles the letter perceives at once can be considerably improved upon. We do not consider it our duty to reject the letter because we see a better way of doing the work than that which was followed by the writer of the letter, but believe the better plan for us is to publish the letter, giving the writer of it his chance to be heard. This letter is very likely to call out from other contributors the better method or methods of doing the work, if there is any such better method. Such a result is of course very desirable, and it has been brought about in very many cases. Indeed, in some instances where, upon the publication of such a letter, no replies to it are received from our machine-shop contributors, a reply may be written by someone connected with the paper for the purpose of showing where the method may perhaps be improved or the work done in a different way, at least, and for the purpose of further stimulating discussion of the question. There are those who seem to assume that whatever appears in the columns of such a paper as ours is believed by the editor to be not only entirely new, but the very best possible way of doing the work described. This is by no means always the case. It is true of some articles, but it is by no means true of all articles.

The *Patent Office Gazette* of January 10 reports a patent for a water wheel issued to Theodore R. Timby, of Brooklyn. Mr. Timby's first patent, also for a water wheel, was dated November 10, 1846, fifty-eight years ago.

New Tools and Machine Shop Appliances.

2x26-INCH TURRET LATHE WITH LOCOMOTIVE OUTFIT.

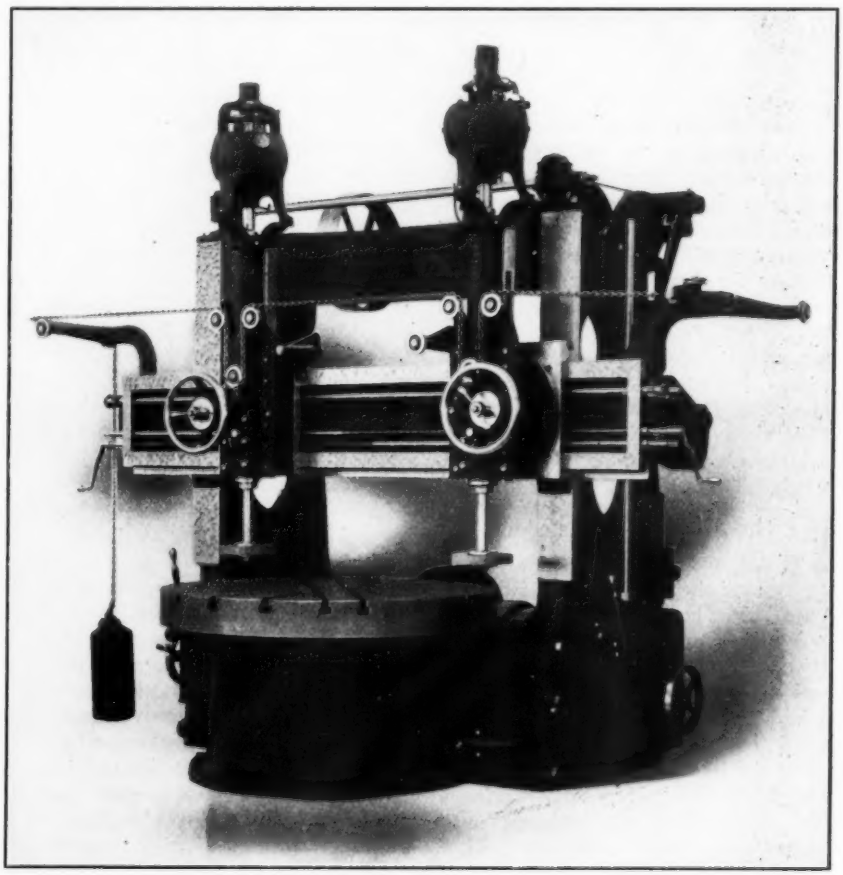
The half-tone shows a Pratt & Whitney 2x26-inch turret lathe with special equipment for handling a wide variety of work in locomotive shops. One of the chief uses of the turret lathe in such shops is for turning bolts. All ordinary bolts can be turned without any special equipment, but for machining the long taper bolts used in locomotive frames a special taper turner is provided, which is usually arranged for a 1-16 inch taper per foot, the standard taper for locomotive bolts. Another class of bolt work for which this machine is adapted is for centering and turning forged bolts, the heads of which are more or less eccentric. The lever scroll chuck shown in the illustration is mounted on one of the turret faces and in it the body of the bolt is placed. The shank of the forging chuck which has two floating jaws is placed in the regular chuck jaws in the spindle. The turret is then run forward, and the bolt, the body of which is held in the scroll chuck, is run into the forging chuck and the jaws tightened on its head. The scroll chuck is then opened, the turret run back and indexed to the first turner required, and the turning proceeded with. The fact that the bolt is held in the chuck on the turret while it is being clamped by the forging chuck insures its being centered correctly. The regular equipment of this machine includes a full set of chuck jaws from ¾ inch to 2 inches in diameter, handling round, square and hexagonal stock; three universal turners which have radial adjustment so that besides for ordinary turning they may be used for facing off the heads of bolts, etc.; an open side turner for bolts and pin-heads above 2 inches in diameter; a taper turner; a bell-mouthed pointing tool; an opening die head with roughing and finishing attachment, with full set of thread dies; a 6-inch lever scroll chuck; a forging chuck; a 12-inch combination lathe chuck; and bushings, collars, rod supports, etc. It will be seen from this list of tools that the machine is adapted for a wide variety of engine lathe work. The double cross-slide is of particular value, as it enables work to be cut off while turning is in progress, and also will hold heavy forming tools.



2x26" TURRET LATHE WITH LOCOMOTIVE SHOP OUTFIT.

A BORING MILL FOR GRINDING SAFES WITH CIRCULAR DOORS.

The illustration shows a standard 72-inch boring mill fitted up with grinding spindles and emery wheels in place of regular heads, for grinding circular safe doors and their seats. The material of which the safes are made is so hard that it cannot be touched with any kind of tool, but it yields readily to an emery wheel. The edges of the door are conical and the swiveling feature of the heads allows the exact taper to be obtained. For grinding the seat the safe itself is placed upon the table and the spindles set for the correct taper. For grinding the doors the spindles are set for the opposite taper. A perfect joint is obtained in this manner with a circular door that is impossible to get with any other shape. In fitting this mill up for grinding, the regular heads are bored out and bronze bushings are inserted, one at the top and one at the bottom. These bushings are bored out conical and special arrangements are made for taking up all wear, thus preserving the alinement of the spindles. The oiling device is so arranged that perfect lubrication is insured without the oil overflowing and running down on the spindles.



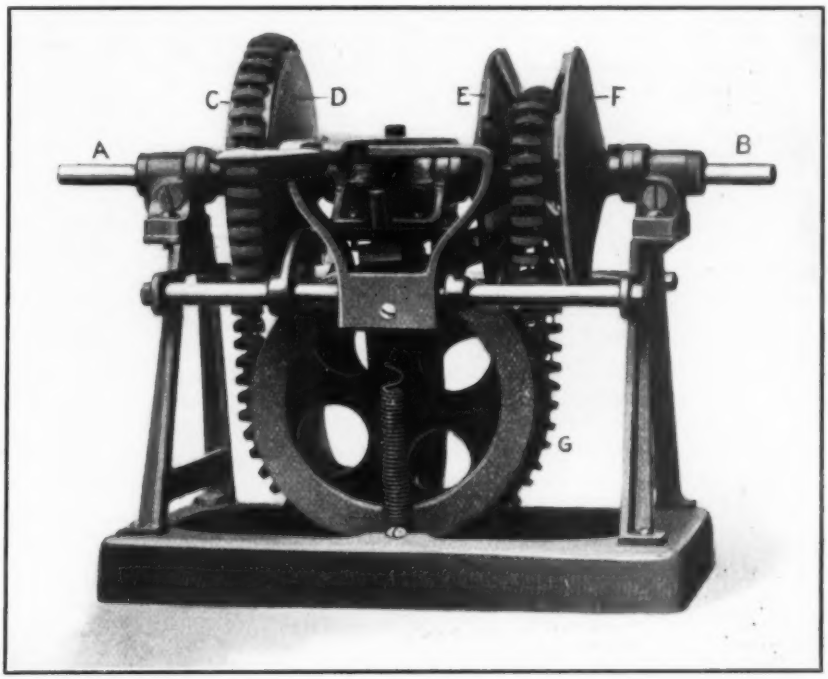
BORING MILL ARRANGED FOR GRINDING SAFE DOORS AND SEATS.

Each spindle is connected at the top direct to a 2 horse-power Northern 220-volt motor. The motors are of the vertical type and are attached to and supported by the rams which carry the spindles. The spin-

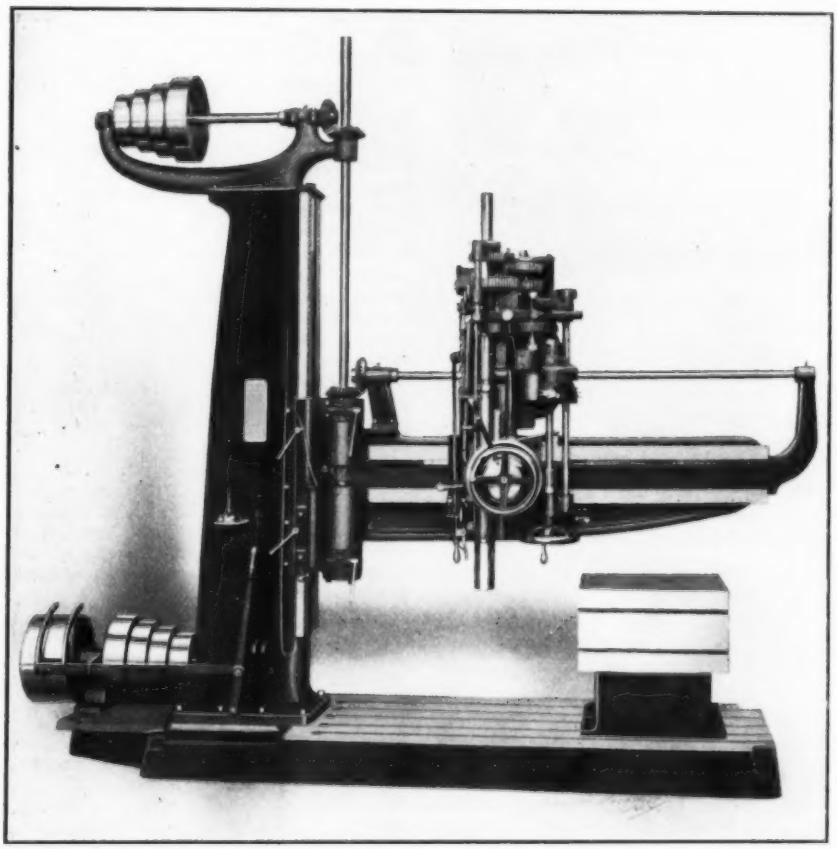
dles can be raised and lowered in vertical or angular directions and no trouble whatever is experienced in driving them as the motors travel with the heads. While this arrangement was designed for grinding safes and doors, it is equally well adapted to a great variety of other work, the design of the mill being such that the changes illustrated can be easily made. In case it is desired to use the mill at any time for turning or boring, the spindles and their journals can be quickly removed and the regular tool heads substituted. This machine is built by the Colburn Machine Tool Company, Franklin, Pa.

A NEW FIVE-FOOT RADIAL DRILLER.

The half-tone shows the new "standard" five-foot arm radial drill built by the Fosdick Machine Tool Company, Cincinnati, Ohio. This machine with cone drive has twelve speeds and with speed box it has eighteen speeds. The driving pulleys are placed either on the side or the back of the column as ordered, so that the drill may be set parallel with or at right angles to the line shaft. The arm swings on ball bearings and is raised or lowered by power. The head is moved along by rack and pinion and may be clamped at any point. An automatic trip does away with all measurements in drilling, as the pointer may be set to begin its reading from any position of the drill and then it drills to the predetermined depth. There are eight changes of feed, from .007 to .065 inch to each rotation of the spindle. A tapping attachment on the head has a powerful friction clutch operated by a lever placed handy for the operator. A few of the details are here enumerated: Traverse of spindle, 16 inches; least diameter of spindle, 1 13-16 inches; minimum distance column to spindle, 13½ inches; traverse of saddle on column, 42 inches; traverse of head on arm, 48 inches; maximum distance from spindle to base plate, 60 inches; table, 22x22x22 inches; spindle speeds, 16 to 375 revolutions per minute; weight of machine, 7,000 pounds; largest twist drill in solid gray iron, 4 inches; largest pipe tap in gray iron, 4 inches. Drills to center of 120 inches. On the side of the column is a brass index plate showing speeds at which twist drills should be run.



A VARIABLE SPEED DEVICE.



A FIVE-FOOT RADIAL DRILLER.

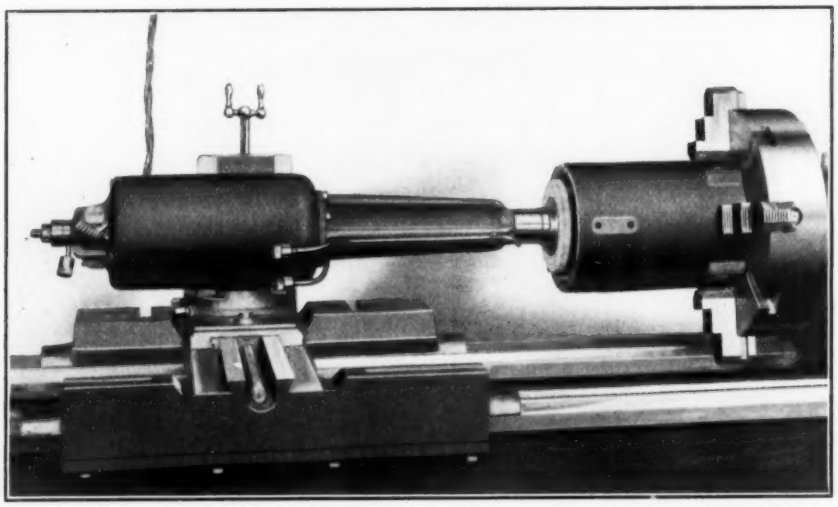
A NEW VARIABLE SPEED DEVICE.

In the mechanism here shown either shaft may be the driver and the other the driven. The shafts both extend into the middle of the apparatus, the ends running close together but preferably not touching. The transmission of the motion is by means of the endless belt or chain which in running is bedded between a pair of the interlocking conical faced pulleys, as *E* and *F*, passing down around the idlers *G* and up over the other pair of conical faced pulleys *C D*. It will thus be seen that the two shafts turn in opposite directions. It will be seen also that the relative speed of rotation of the two shafts will depend upon the distances between the members of each pair of conical faced pulleys, the changing of this distance changing the radius at which the chain will work. Assuming *A* to be the driving shaft, it is evident that *B* must turn much faster, as the pulleys *C* and *D* are close together and the chain is working between them at about the largest possible radius, while between *E* and *F* the chain works at a much smaller radius. By moving *C* and *D* apart and moving *E* and *F* together the working radius of the chain on *C D* will be reduced and the radius on *E F* will be increased, the relative speed of rotation of *B* diminishing proportionately. It is evi-

dent that a wide range of speeds may be produced by this means. *C* is keyed to shaft *A* and *F* is keyed to shaft *B*. *D* and *E* are fastened upon sleeves which slide freely upon their respective shafts. A sliding bar carries forks which fit circular grooves upon the sleeves, and by this means both sleeves and their pulleys are moved simultaneously in either direction. The two idlers *G* are swiveled to turn upon vertical axes to accommodate the changing working diameters of the pulleys above. A round belt or rope may take the place of the special chain belt here shown. This device is the invention of C. L. Rosenqvist, 167 Buffalo avenue, Niagara Falls, N. Y.

ELECTRICAL INTERNAL GRINDER.

A new tool recently put on the market, in the shape of a portable electrical internal grinder, is here illustrated at work. It is especially designed for grinding and finishing gas, steam and air cylinders,



ELECTRICAL INTERNAL GRINDER.

grinding out dies, truing up bearings and cylindrical grinding of any kind. Its value to engine builders and machine shop use in general is at once apparent. The gross weight of this grinder is 76 pounds. The motor will develop about 1 horse-power. Motor dimensions, 6x12 inches with the spindle extended 12 inches, altho it can be made longer if desired. The minimum size of hole this machine will grind is 3½ inches.

This grinder is bolted to the tool-post rest of a lathe by means of an angle plate, and has a vertical adjustment to bring it in line with the centers. The driving power is obtained from the ordinary incandescent lamp socket, direct current. This machine is manufactured by the Hisey-Wolf Machine Company, Cincinnati, Ohio.

A bill has been introduced in the Illinois Legislature to prevent selling electricity at wholesale. There must be no differences made in rates in favor of large users.

The New President.

The inauguration of the President is an event which should be chronicled even in the pages of a technical paper. It is the triumph of a striking personality. Whether as the spokesman of national impulses or a politician playing a difficult game with a masterly hand, whether as the representative of university culture or the type of those breezy men of action who have conquered the West, Mr. Roosevelt has been able to command the applause of the gallery while winning the respect of the critic. To us he seems in a peculiar way to epitomize the great nation which has chosen him Chief Executive. In the lustiness of his manhood, in his untiring activity, in the giving of much advice and the taking of little, in the cocksureness of his philosophy, in sensitiveness to criticism, in the breadth of his enthusiasms, in directness of speech, and in superb self-confidence, in all of these, he is—from the crown of his masterful head to the sole of his confident foot—an American! —*The Engineering and Mining Journal.*

Personal.

B. Franklin Mahler has severed his connection with the Yale & Towne Manufacturing Company. He was for four years connected with the chain block department.

W. W. Totman, formerly superintendent of the Fellows Gear Shaper Company, of Springfield, Vt., is now engaged with the Whitney Manufacturing Company, of Hartford, Conn., as traveling representative.

Obituary.

Thomas Findlay, head of the Findlay Machine Works, Oswego, N. Y., died February 17, seventy-five years old.

H. S. Pollard, an American engineer in charge at a new blast furnace near Middlesborough, England, was instantly killed March 11 by the explosion of a gas tank.

B. Frank Beatty, head of the Beatty Edge Tool Company, Philadelphia, died at Chester, Pa., March 11, fifty-five years old. He was a grandson of Wiliam Beatty, a pioneer of the edge tool trade.

Thomas Insull, a manufacturer of wagon springs, died in Philadelphia, March 7, seventy-seven years old. Mr. Insull came to this country from England in 1866, locating first in New Haven and going to Philadelphia two years later, where he soon started the spring business which has been continued up to the present.

We have recently learned of the death of Robson C. Greer, tho he died at his home in Lebanon, Pa., December 16, 1904. Mr. Greer at the time of his death was only thirty-eight years old, but during his life had done considerable important engineering work. He was for some years mechanical engineer with the Pope Manufacturing Company, of Hartford, Conn., and while there designed or perfected the design of the first chainless bicycle. He was afterward with the Worthington Hydraulic Works, of Brooklyn, as assistant superintendent, and was also for a time superintendent of the Wheeler Condenser & Engineering Company, of Carteret, N. J. Latterly he had been a member of the Greer-Clarkson Company, of Manheim, Pa., which company was doing general machine work and mechanical engineering. He also built and equipped several large shops, among them the Hydro-Carbon Burner Company, of Marion, N. J. He was a member of the American Society of Mechanical Engineers.

Business Items.

B. A. Schroder, for some time attached to the St. Louis office of the Crocker-Wheeler Company, has been place in charge of the New Orleans office of the company. Mr. Schroder succeeds W. P. Field, who has been transferred the Boston office.

The Geo. Whiting Company, manufacturer of punches, shears, bending rolls, etc., will remove on May 1 to its new works, 156 to 164 West North avenue, Chicago, Ill. This move was made necessary by the largely increased business of the company.

The Symms & Power Company, heating and ventilating engineer, of Sioux Falls, S. Dak., has added an electrical department in charge of R. R. Keely, M. M. E., until recently engineer with the Westinghouse companies of New York. The company will continue in heating and ventilating work and will take up power-station work, including power generation and electric transmission in its various applications.

The New Era Gas Engine Company, Dayton, Ohio, has just installed in its machine shop a 60-inch Colburn boring mill which is intended to finish flywheels in almost one operation by the use of four or five automatic heads. The company also expects to install a new cylinder boring machine of the latest improved type, which, added to a number of new machines recently added to the equipment, will enable the company to materially increase the output of the works.

The boiler plant of the Atlantic Product Company, Atlantic City, N. J., has recently been equipped by the B. F. Sturtevant Company with a mechanical forced-draft equipment for six 150 horse-power boilers. The fan, which is driven by a horizontal engine, is so arranged as to discharge the air thru an underground duct into the hollow bridge

wall, from which it escapes to the ash pits thru special dampers under the control of the fireman. The pressure thus created within the ash pit is uniform over the grates and conducive to a greatly increased rate of combustion.

The High Duty Saw & Tool Company has been incorporated at Harrisburg, Pa., the incorporators being Adam Tindel, L. I. Morris, Lincoln W. Gruber, Otto Albrecht and William Stoll, Jr. The capital of the company is $50,000, and its purpose is the manufacture of the Tindel high-duty metal-cutting saw blades and high-powered sawing machines on which they are to be used. The officers of the company are: Adam Tindel, president; L. I. Morris, vice-president; Lincoln W. Gruber, secretary; Adam Tindel, treasurer. The office of the company is at Eddystone, Pa.

The Philadelphia Pneumatic Tool Company announces that it has assigned all its business, patents, trade-marks and good will to the Chicago Pneumatic Tool Company and is to join interests with the latter company. Julius Keller, formerly president of the Philadelphia company, has become a director in the Chicago company and will have the direct management of the Philadelphia plant, which will be operated as before for the manufacture of Keller hammers, drills and other tools. It is understood that other officers of the Philadelphia company, as well as the selling force, will be taken care of by the Chicago company.

Much recent legislation looking to the comfort of employees has had to do with the maintenance of proper temperature and purity of the air in manufacturing plants. The nature of the work in connection with the manufacture of iron, and products therefrom, especially calls for devices which shall not only add to the comfort of the workmen, but at the same time increase their output. With this object in view the tube works department of the Reading Iron Company, Reading, Pa., has recently made a special appplication of two large electric fans manufactured by the B. F. Sturtevant Company, of Boston, Mass., for supplying blast for cooling around the furnaces. Similar devices, we are informed, are being adopted in many large plants where work of this character is carried on.

The business of The Fairbanks Company, in Canada, including all its selling agencies, contracts, organization and warehouse stocks of goods at Montreal, Toronto, Winnipeg and Vancouver, has been purchased by Henry J. Fuller in order to reorganize it as a Canadian institution, and the business will be conducted, on and after March 15, as the Canadian Fairbanks Company, Ltd., Mr. Fuller being president and treasurer. It is his intention to very shortly begin the erection of a large plant for manufacturing in Canada specialties which they have heretofore imported. The first move will be to remove the Montreal warehouse into new quarters at 444-446 St. James street on the first of May next, the old quarters on Craig street being retained for the present, as the extra space will be needed for the increase of business.

The Westinghouse Electric & Manufacturing Company is building for the People's Power Company, of Moline, Ill., two engine-type generators to be installed in its power station. An order for three 300-kilowatt, alternating-current generators has also been placed with the Westinghouse Company by the Barber Lumber Company, of Boise, Idaho. The necessary transformers, switchboards and lightning arresters are included in the apparatus to be furnished. The Mammoth Copper Mining Company, of Salt Lake City, has just placed an order with the Westinghouse Company for a large addition to its electrical equipment. A total of nearly 800 horse-power in induction motors of different sizes, together with a motor-generator set, transformers, switchboard and three mining locomotives, is included in the order.

In April next the machinery business of McDowell, Stocker & Co., Chicago, will have been established ten years. The foundation of the firm was principally laid on its sale of second-hand machinery, a business at that time in its infancy in Chicago, but the partners reached out for and gradually acquired the agency for lines of new machinery. The offices of the concern are now located on the first floor of the building at 59 and 61 South Canal street. The long lease on the warehouse which the company has utilized has been disposed of, and the store immediately adjoining the present offices to the south has been opened. Among some of the machine tools for which McDowell, Stocker & Co. are selling agents in Chicago and vicinity are the following: Becker-Brainard milling machines, Bradford engine lathes, Burke bench milling and tapping machine, Colburn boring mills, Fosdick radial drills, Hamilton engine lathes and drill presses, Belmer planer, Whitcomb planer, Consolidated power presses, Kempsmith milling machines, Springfield engine lathe and shaper, Milwaukee shapers, Diamond Machine Company's grinders, Harrington lathes and multiple spindle drills and Walcott shapers.

Manufacturers.

The Cordele (Ga.) Marble Company is erecting a plant.

Max Hertz, Newark, N. J., will erect a new leather factory.

The Lestershire (N. Y.) Tinning Company is erecting a factory.

The Textile Machine Works, Reading, Pa., are extending their plant.

The Oil Seed Company, Bayonne, N. J., has filed plans for its new plant.

The Youngstown (O.) Iron Sheet & Tube Company will erect a steel plant.

The Ashland (Wis.) Iron & Steel Company is making additions to its plant.

The Firth-Sterling Steel Company is enlarging its plant at Demmler, Pa.

O. T. Denison will build a $50,000 sewer tile factory at Manson City, Ia.

The Beaumont (Tex.) Rice Mills will erect a new mill, to cost about $75,000.

Lymburner & Matthews, Montreal, Canada, brass molders, will erect a factory.

The Meriden (Conn.) Curtain Fixture Company is making an addition to its plant.

The Monarch Grubber Company, Lone Tree, Ia., will make an addition to its factory.

The Union Hardware & Metal Company, Los Angeles, Cal., will erect new buildings.

The Grand Rapids (Mich.) Gas Light Company will expend $150,000 in improvements.

The glass factory of Henry C. Fox & Sons, Philadelphia, Pa., has been destroyed by fire.

Wm. J. Dunn has begun the construction of a cotton waste mill at Fall River, Mass.

The carriage factory of Chas. P. Woolsen, Riverton, N. J., has been burned; loss, $25,000.

The Century Electrical Works, San Francisco, Cal., will erect a factory in Richmond, Cal.

The J. B. Morris Foundry Company, Cincinnati, O., will build an addition to its plant.

The Standard Bending & Art Glass Company, New Haven, Conn., will extend its plant.

The plant of the West Muncie (Ind.) Mineral Wool Company, recently burned, is being rebuilt.

The Oriental Emery Company's plant at Derby, Conn., was destroyed by fire; loss, $25,000.

The factory of the Consumers' Match Company, Clifton, N. J., has been burned; loss, $25,000.

The Jewett City (Conn.) Textile Novelty Company's plant has been burned; loss, about $60,000.

The Carroll Foundry & Machine Company, Bucyrus, O., will erect a new steel foundry building.

The American Dyewood Company, Chester, Pa., will erect a new boiler-house and a machine shop.

The Consolidated Car Heating Company, Albany, N. Y., will make extensive additions to its plant.

The Lakeside (Wis.) Malleable Iron Works have been destroyed by fire, entailing a loss of $125,000.

It is reported that the Simplex Railway Appliance Company, Montreal, will put up new buildings.

Mertz Sons, East Port Chester, N. Y., contractors and builders, are making an addition to their factory.

An appropriation of $50,000 has been secured for a small arms factory at the Augusta (Ga.) Arsenal.

The Union Metallic Cartridge Company has let contract for four factory buildings at Bridgeport, Conn.

The Edison Sault Electric Company, Sault Ste. Marie, Mich., will erect a plant on the St. Mary's rapids.

The American Textile Company will make an extensive addition to its picker building at Cartersville, Ga.

The Midvale Steel Company, Nicetown, Pa., has awarded contract for a $10,000 extension to its machine shop.

The Dartmouth Manufacturing Company, New Bedford, Mass., contemplates an addition to its cotton mill.

The Business Men's League, of Parkersburg, W. Va., is in communication with a firm in Hartford City, Ind., which is thinking of locating its glass plant at the former place.

A company has been formed to utilize the waters of the Columbia River to furnish power for manufacturing, pumping and irrigation purposes. The ditch is to be 20 feet wide at the bottom and 40 feet at the top, and at the deepest place 30 feet. Full information can be obtained by addressing M. D. Kelley, Seattle, Wash.

New Catalogs.

L. Robbins, Worcester, Mass. Catalog of engine lathes and patternmakers' lathes. Illustrated. 6x9, pp. 19, paper.

The Burke Machinery Company, Cleveland, O. Catalog of sensitive drills and tapping machines. Illustrated. 6x9, pp. 10, paper.

Cincinnati Electrical Tool Company, Cincinnati, O. Catalog of portable electric drill and grinder with half-tone illustrations, tables and line drawings. 6x9, pp. 8, paper.

Bay State Tool Company, 294 Washington street, Boston, Mass. Catalog describing monkey and pipe wrenches and compound leverage punch. Illustrated. 3x6, pp. 7, paper.

Weber Gas & Gasoline Engine Company, Kansas City, Mo. Catalog No. 21, on multiple cylinder vertical engines and Weber suction gas producer, containing tables and half-tone illustrations. 7½x11, pp. 20, paper.

Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. Folder No. 4032, entitled "Wattmeters and How to Read

Them." This gives very definite information for the reading of meters. Illustrated. 5x7, pp. 14, paper.

Sprague Electric Company, 527 West Thirty-fourth street, New York. Bulletin No. 505, describing flexible steel-armored hose for steam or compressed air. Illustrated. 8x10½, pp. 8, paper. Bulletin No. 309, "Electric Fans." Illustrated. 3½x6, pp. 11, paper.

Ingersoll-Sergeant Drill Company, 26 Cortlandt street, New York. Bulletin No. 2000, describing the MacDonald rivet forge. This is an advance copy of the first of a series of bulletins describing "Labor-Saving Tools Operated by Compressed Air," to be issued by the pneumatic tool department of this company. The series will be sent to anyone interested enough to send their name and address.

B. K. Morton & Co., Sheffield, England (Baines & Peckover, Toronto, Ontario, agents). "Mainly About Steel" is the title of a booklet which contains a lot of useful information regarding Morton's tool steels, of different grades and tempers, for various services, with instructions for forging, hardening, tempering and grinding. A number of pages of tables and data valuable to steel users are appended. 3½x6, pp. 31, paper.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Light drop forgings to order in quantities. Remington Arms Company, Ilion, N. Y.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Any manufacturer desiring to build gas engines address Box 386, AMER. MACHINIST.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Screw machine work to order up to ⅞ in., in quantities. Remington Arms Company, Ilion, N. Y.

Automatic machinery designed and constructed by the Wellman Sole Cuting Machine Co., Medford, Mass.

"The Mechanical World Pocket Diary for Machinists and Draftsmen," 1905 edition, price 75c. Address James Saunders, New Castle, Del.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

Up-to-date plant, equipped for manufacture of medium size machinery, will take contract for automatic or interchangeable machinery on which careful work is desired. Box 396, AMERICAN MACHINIST.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, gray, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

Factory Accommodation for Rent.—American manufacturers desiring to open manufacturing branches in Canada can secure accommodation from the undersigned. Steam heat, electric light and power, natural gas, railway switches at door. Abundant labor. Write for particulars. State what you want. The Mill Properties Company, Limited, Dundas, Canada.

For Sale.

For Sale—Long-established machine shop in this thriving city; cause of sale, death in firm. W. D. Judson, New Haven, Conn.

Shafting straighteners, 1¼ to 5 in.; also horizontal cast column disc sander and rolls for flattening wire; both cheap. J. H. Wells, Tampa, Fla.

New course mechanical engineering, International Correspondence School; will sell cheap. Address Mr. G. Gray, 21 Ward st., Orange, N. J.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Position wanted as designing or chief draftsman or checker; automobile or gas engine work preferred; have had successful experience. Box 414, AMERICAN MACHINIST.

ILLINOIS.

Permanent position, by quick estimator and competent designer of inventive and executive ability; traveling cranes, elevators and general hoisting machinery; qualified to start concern in these branches; references; location immaterial; technical education. Box 273, AMERICAN MACHINIST.

I want situation as patternmaker or draftsman, within 100 miles of Chicago; or location for a job pattern shop with some firm who can guarantee some work; I am a first-class patternmaker, American, with wide experience; good mechanical draftsman; want a change. Box 403, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical draftsman wishes position. Address Box 419, AMERICAN MACHINIST.

Responsible position by technical man, age 34, experienced in shop and drafting room. Address Box 404, AMERICAN MACHINIST.

Foreman of machine shop, with good experience on large and small high-class work; jigs, fixtures and tool designing. Box 400, AMERICAN MACHINIST.

A competent man, willing to prove the statement, desires opportunity to design, erect and install new machine shop and power plant as per best modern practice, or to enlarge and improve on present installation. Box 411, AMERICAN MACHINIST.

NEW JERSEY.

Draftsman, experienced on general and special machinery. Box 383, AMER. MACHINIST.

Toolroom foreman, 22 years' experience—jigs, dies, novelty manufacturer preferred—wishes to change present position immediately; references. Box 399, AMER. MACHINIST.

Young man, 23, has 6 years' experience in machine shop on tools, dies and general shop work, also 1 year in drawing room, wishes position where there is chance of advancement. Address Box 418, AMER. MACHINIST.

NEW YORK.

Milling machine man, 14 years' experience, desires change of position; would take charge. Box 423 AMERICAN MACHINIST.

Mechanical draftsman, with shop managing and organizing experience, wants position; age 30. Box 416, AMERICAN MACHINIST.

By excellent draftsman, 35, quick worker, from 8 to 12 A. M., in or around city (teaching afternoons). Box 412, AMER. MACH.

Mechanical draftsman; young man; 23 years; 2 years technical school; 2 years' experience. Box 398, AMERICAN MACHINIST.

Toolroom apprentice, 2½ years' experience, wants position to finish trade; moderate wages. Box 413, AMERICAN MACHINIST.

Position as superintenent or general foreman; modern methods; mechanical and technical training. K. C., care AMER. MACHINIST.

Brass molder wants position; 20 years' experience on general jobbing, heavy or light; willing to go to any part of United States or Canada; sober and industrious. Address Box 364, AMERICAN MACHINIST.

I have experience as designer, patentee and manufacturing, typewriters, typewriter adding machines, adding machines and automatic machinery; want situation as superintendent or draftsman and designer. Address Box 410, AMERICAN MACHINIST.

An energetic gentleman (26), with practical experience along mechanical and electrical lines, possessing executive ability and commercial experience with large company, desires to locate with small concern in some responsible capacity; holding responsible position at present. Address "Energy," care AMERICAN MACHINIST.

OHIO.

Wanted—Situation as foundry foreman, by an up-to-date foundry man with 18 years' experience; jobbing or machinery shop of 10 to 15 molders preferred. Address "Foundry," care AMERICAN MACHINIST.

PENNSYLVANIA.

Mechanical engineer wants responsible position, in Boston or vicinity; 17 years' experience; best references. Box 415, AM. M.

Mechanical draftsman wants position; technical graduate; 3 years' shop experience and 4 years in the drafting room. Box 402, AMERICAN MACHINIST.

Mechanical engineer and designer; 20 years' experience; machine tools, hydraulic and structural shop machinery; plant design and improvement. Box 401, AMER. MACH.

VERMONT.

Mechanical draftsman is open for permanent position; 8 years' experience on hydraulic work; first-class designer on valves and special machinery for gas, water and steam. J. H. W., care AMERICAN MACHINIST.

Help Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Wanted—Draftsmen for tools, gauges and fixtures; none but first-class men wanted. Ross Rifle Co., Quebec, Canada.

Wanted—Foreman for Canadian machine shop turning out duplicate work; applicants must be first-class mechanics, well up in modern shop practice and know how to handle men to advantage; wages $5 per day; yearly contract to right man, with a chance to improve his position. Box 323, AMER. MACH.

ILLINOIS.

Wanted—Sale producer with mechanical and technical education and experience; good chance for capable, energetic man; advise fully relative to experience, age, references and salary expected. Box 421, AM. MACH.

Wanted—Foreman patternmaker to take charge of a small pattern shop employing 3 to 8 patternmakers, in Middle West; must be a hustler and cost reducer; send full credentials; state age and experience. Box 370, AMERICAN MACHINIST.

Wanted—Assistant superintendent for shops in machinery line; must be thoroughly up to date in best machine tool work, piece-work practice, etc.; growing position for young man of ability and energy; state salary; location, Middle West. Box 357, AMER. MACH.

Wanted—Machinist, electrical shop foreman; one able to handle help and to make jigs, etc.; machinist, not an electrician, is needed; good chance for right kind of young man, even if not experienced in all shop practice. T. & A. Selective Call Co., Geneseo, Ill.

INDIANA.

Wanted—Machinist; a first-class man as fitter on screw machines. Box 392, AM. M.

Machine shop superintendent, up to date in modern tool practice and shop management, to take charge of machine shops in a large factory having a variety of light and medium work; a hustler, capable of producing results that are accurate; give experience and references. Box 408, AMER. MACHINIST.

MARYLAND.

Wanted—For gas engine work, toolmakers, machinists, flat turret machine hands and draftsmen; steady work; fine opportunity. Box 395, AMERICAN MACHINIST.

MASSACHUSETTS.

Wanted—First-class non-union drop forger, accustomed to general work; state wages and references. Address "Steady Job," care A. M.

MICHIGAN.

Draftsman wanted; strictly first class, experienced designer and draftsman on automobile work, jigs and fixtures; must be neat, accurate, rapid; good position to right man; give full particulars, salary expected, etc. Box 422, AMERICAN MACHINIST.

NEW JERSEY.

Wanted—A machinist who has had experience in accurate grinding, to take charge of a department of a large manufacturing company, located in Newark, N. J. Box 397, AMERICAN MACHINIST.

Lathe, planer and boring mill operators

The United States Arsenal at Rock Island—VII.

BY F. A. STANLEY.

In examining the "United States magazine rifle, model 1903," and comparing it with its predecessor, the Krag-Jorgensen, whose manufacture at the Springfield Armory was discontinued a year and a half ago, the features first to attract one's attention are the shortened barrel; the absence of the projecting magazine so conspicuous at the side of the other rifle; the rod bayonet, of which, ordinarily, only the extreme tip is visible; the lengthened hand guard extending from the rear sight base almost to the front sight stud, thus covering the barrel for nearly its entire length.

SOME ADVANTAGES OF THE NEW RIFLE OVER THE OLD.

The barrel is now but 24 inches long—or 6 inches shorter than the barrel of the Krag—and the total length of the gun is kept down to 43½ inches, or about the same as the regular carbine, thus adapting the one rifle to both the cavalry and infantry arms of the service. The magazine, which is now made in one piece with the trigger guard, is centrally located in the stock and is therefore practically invisible.

The rod bayonet and the shortened barrel aid materially in reducing the load the soldier must carry and the total weight of the rifle with bayonet is but 8.9 pounds, while the earlier gun with bayonet and scabbard weighed 10.6 pounds. The substitution of a knife bayonet of some form for the rod bayonet is being considered, on account of the close fighting, especially at night, reported from the battlefields of the Far East.

But the most important feature of the new rifle is one of which there is little outward indication—until the breech bolt is inspected: A glance at this member, however, with its strong, double locking lugs and heavy safety lug suggests at once that the arm must be a very powerful one, and such is the case; in fact, it is said to be the most effective rifle in use in any army to-day. Of the same caliber, .30, as the Krag-Jorgensen, and using a cartridge with the same weight of bullet, that is 220 grains, this rifle has been so strongly designed as to allow a 43½- to 44½-grain charge of nitro-glycerine powder to be employed as against 37.6 grains for the Krag, the powder pressure in the chamber being raised to 49,000 pounds per square inch, where in the former gun it was but 38,000 pounds, and the initial velocity thus being raised from 2,000 feet per second to 2,300 feet, the muzzle energy from 1,952 foot-pounds to 2,582 foot-pounds, and the maximum range increased from 4,066 yards to 4,781 yards—a gain of nearly one-half mile. The penetration in white pine at 50 feet is 54.7 inches, or nearly 9 inches greater than with the earlier arm. Still another interesting item in connection with these data is the exceedingly flat trajectory or curved path followed by the ball, the maximum ordinate for a 1,000-yard trajectory being but 19.6 feet, as against 25.8 feet for the old rifle.

A FEW POINTS IN CONNECTION WITH THE RECEIVER, BOLT, AND EXTRACTOR.

Now that we have been over some of the important figures relating to this firearm let us take up some of the features of construction, a few of which have already been referred to: The neat lines of the piece as a whole are brought out clearly in the half-tone Fig. 53; the arrangement of the various parts of the mechanism will be understood from the drawing Fig. 54, where the names of the ninety-two component parts are given. Fig. 55 gives a view of the top of the gun with the breech mechanism closed, and shows also several receivers and bolts, which pieces are further represented in the line engraving, Fig. 56, where as in the half-tone the bolt is depicted with extractor and collar removed.

As has been stated in an earlier article, the receiver and bolt are two of the most interesting parts in the mechanism, the receiver alone requiring some eighty-odd operations to bring the forging as it leaves the drop shop, to the finished stage represented in the engravings, and during these operations the blank is cut down in weight from about 5 pounds to 15½ ounces. Reference to the illustrations will show that some very nice work has to be done in machining these as well as other important parts, and, as all pieces whether of Rock Island or Springfield manufacture must be interchangeable, some interesting gaging operations are involved in holding the pieces to the necessary limits of accuracy. These limits, it should be noted, are very small in any case, and in certain parts of the work no variation whatever is permissible, the work being held dead to size without allowance either side of standard.

The method of connecting barrel and receiver and receiver, magazine and stock, and the manner in which the breech bolt is adapted to rotate and slide in its well in the receiver, are clearly shown in Fig. 54. In the longitudinal section in that drawing a cartridge is shown in its chamber, with the bolt closed, and the piece cocked and ready for firing. It will be noticed that the cartridge is a headless affair and grooved near the base of the shell to admit the head of the extractor. The latter is attached to the bolt by means of a ring or collar fitting in a groove formed around the bolt and its bushed end or head rests between the two locking lugs. This design of bolt and extractor, by the way, and the construction of the magazine, are more along the lines of the Mauser than the Krag-Jorgensen construction superseded in the new design.

FIG. 53. THE U. S. MAGAZINE RIFLE, MODEL 1903.

CHARGING THE MAGAZINE.

The magazine is shown filled in one of the cross-sections in Fig. 54; other views show it empty. To charge it (the bolt of course being drawn back) five cartridges held one on top of another by a narrow brass clip whose edges are bent over to engage the grooves in the cartridges, are placed in the magazine opening in the receiver with the clip resting vertically in a pair of notches at the rear of the opening; the thumb then presses the cartridges down thru into the magazine, where they assume the position indicated in section *CC*. When the bolt is shoved forward the clip is ejected. The magazine may be charged also by dropping in cartridges from the hand, one at a time. Ordinarily, the magazine will be held in reserve and single loading and firing resorted to, the "cut off," to be explained later, being set to allow the bolt to slide back sufficiently to permit a cartridge to be dropped into the receiver by hand, but not allowing the cartridges in the magazine to rise into the receiver.

OPERATION OF THE RIFLE.

Now, altho the drawing represents the rifle cocked, with a "live" cartridge in place, suppose for a moment that the piece has been discharged and all that remains of the cartridge is the empty case or shell which must be ejected before another shot can be fired. Also suppose the magazine to be full and the cut off so set as to allow the magazine to be thrown into action: Grasping the bolt by the ball tipped handle at the rear, we eject the empty shell, reload from the magazine, and recock the rifle, the series of operations being performed by lifting the bolt handle until it strikes the back of the receiver, drawing the bolt to the rear till stopped by the cut off, then quickly pushing it forward as far as possible and snapping down the handle upon the receiver.

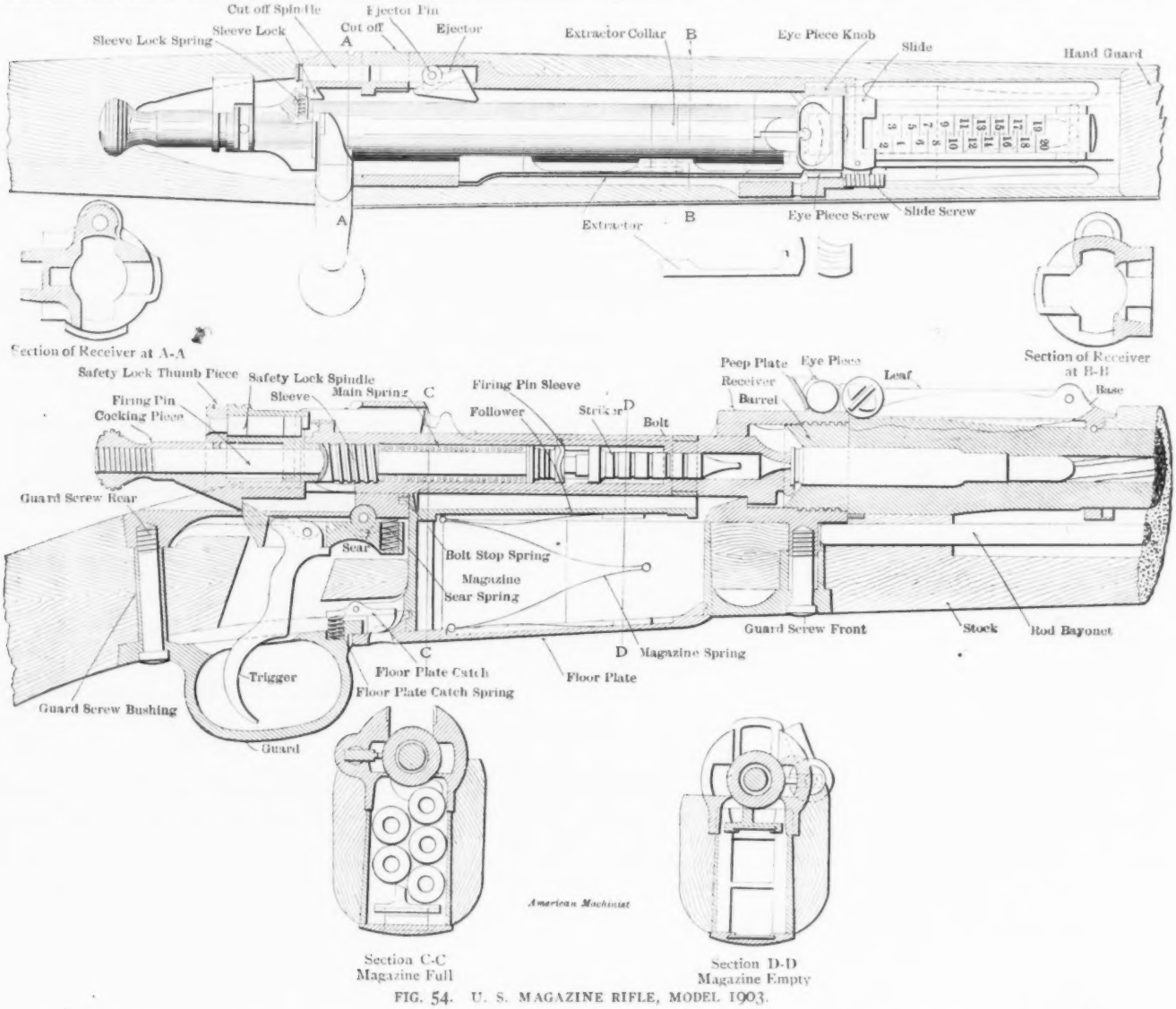


FIG. 54. U. S. MAGAZINE RIFLE, MODEL 1903.

As the bolt is turned to the left by the lifting of the handle, the two locking lugs at the front end are separated from the locking shoulders in the receiver, these being of such a form as to permit the bolt to turn easily. At the same time the cocking operation is started, a cam *A*, Figs. 55 and 56, engaging the inner end of the cocking piece shown in Fig. 54 and forcing back that member with the firing pin until the striker point is well inside the bolt. As the cocking piece is drawn back, it is kept from turning by a narrow lug playing in a longitudinal groove in the receiver; and by the time the bolt handle comes in contact with the receiver, the nose of the cocking piece has entered the notch at the heel of cocking cam *A* in the end of the bolt, the sear notch of the cocking piece has passed the sear nose, and the main spring is almost completely compressed, this spring being confined, as indicated, between the sleeve threaded to the rear end of the bolt and the rear end of the firing-pin sleeve which connects firing pin and striker. The threaded sleeve referred to above connects various parts of the bolt mechanism in the manner shown, and is kept from turning with the bolt by lugs which engage with the receiver. Just as rotation of the bolt ceases, the sleeve is fastened to it to prevent disarrangement of the parts when the bolt is withdrawn, by the spring-actuated sleeve lock shown in the left-hand lug.

Still another result of this first movement of the bolt to the left is to start the empty cartridge case from the chamber: The narrow hook at the end of the extractor is already in engagement with the groove of the empty case and holds the head in the countersink of the bolt; and as the bolt is turned and the locking and safety lugs clear their shoulders in the receiver, the extracting cam *B* (Figs. 55 and 56) contacts with a corresponding cam surface *C* (Fig. 56) and the bolt is forced to the rear, starting the cartridge case from its seat. As the safety lug and the two locking lugs are now opposite their channels formed in the receiver, the bolt is drawn directly to the rear; the slotted top locking lug (which is of course at the back, now that the bolt is turned one-quarter way round) straddles the triangular ejector pivoted near the rear of the receiver, and, the heel of the lug striking the flanged heel of the ejector, the point of the latter is forced under the head of the empty shell which is then thrown out sharply to the right of the gun. The bolt is stopped in its rearward travel by the cut off and the magazine spring then lifts a cartridge into the receiver opening;

the head is at once engaged and held by the extractor hook (thus preventing double loading from the magazine) and the bolt as it is pushed forward carries the cartridge up the ramp of the receiver and into its chamber.

When the extracting cam on the bolt strikes the corresponding cam on the receiver the cocking piece is engaged by the sear nose, as shown in the general drawing, and the sleeve lock is forced into its recess, thus unlocking the sleeve from the bolt. The latter is then turned to the right, the cam surfaces on the locking lugs engaging with the locking shoulders in the receiver and drawing the bolt hard home; this completes the compression of the main spring, as the firing pin is held from further forward movement by the means indicated, and seats the cartridge firmly in its chamber. In single loading operations this final forward movement of the bolt also serves to snap the extractor hook into the groove of the cartridge shell. It will be obvious from the foregoing that the piece may be cocked by simply raising the bolt handle and turning it down again; or the cocking piece may be drawn by hand directly to the rear.

In firing, the trigger is pulled until its bearing under the receiver is shifted to the rounded heel, which gives a certain amount of "creep," when a slight further pull to the rear draws down the sear nose and releases the firing pin. In case the handle is not quite down and the bolt fully closed when the trigger is drawn, the cocking piece cam will strike the corresponding cam surface on the bolt and the firing-pin spring will expend its energy in closing the bolt instead of exploding the primer. Of course the cycle of operations as described may be performed with great rapidity, as many as twenty-five aimed shots having been fired per minute, using magazine fire, and twenty-three shots with single loading.

THE CUT OFF FOR THE MAGAZINE.

The magazine cut-off is shown in section in Fig. 54 and is also visible in Fig. 55, where, in the view of the rifle top, the thumb piece is shown snapped up against the receiver, the word "On" indicating that the attachment is set for magazine fire. This side of the thumb piece is polished brightly so that the commander can tell at a glance if the magazine is being used. The other side, which is visible when the thumb piece is turned down, is marked "Off," showing when the magazine is cut off and the piece ready for single loading. The body or hub is pivoted in an opening in the receiver wall, as in Fig. 54, and lies in the path of the slotted locking lug as the breech bolt is drawn back. If the magazine is "off" the lug strikes the front end of the cut off hub and stops the bolt at a point which will not allow a cartridge to enter the receiver from the magazine. When the latter is "on," owing to a recess milled in the cut off body, the bolt can slide back sufficiently to admit cartridges from the magazine. When the last of the five is fired the follower rises and prevents the bolt from closing, thus showing that the magazine is empty. A spring detent holds the cut off in either position, and it may also be set at an intermediate point at which setting it allows the bolt to be withdrawn entirely from the receiver. Another spring pin adapted to engage with depressions in the under side of the locking lug holds the bolt against accidental movement when drawn back for either magazine or single loading.

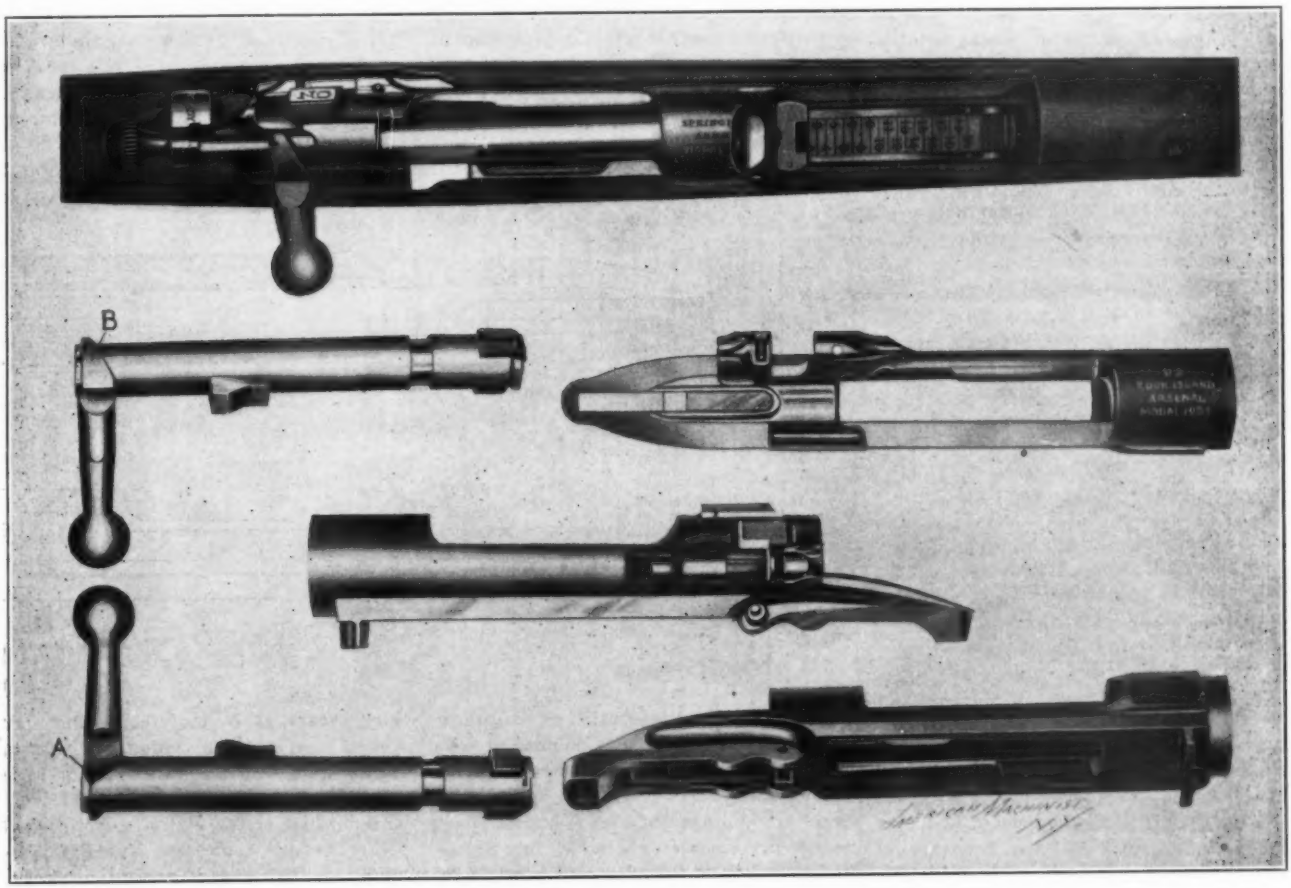


FIG. 55. TOP VIEW OF RIFLE, AND A GROUP OF RECEIVERS AND BOLTS.

USE OF THE SAFETY LOCK.

The safety lock, whose thumb piece stamped "Ready" is plainly visible to the rear of the bolt, provides a means by which the soldier may carry the rifle loaded and cocked, yet without danger of accidental discharge. As shown in the general drawing, this device has a spindle whose inner end is adapted to enter a lock notch in the bolt, and at the rear end is a cam matching lock shoulders in the firing-pin cocking piece. When the bolt is pushed down to the right, thus closing it, the safety lock may be turned over (bringing to view the word "Safe" on the other side of the thumb piece) and the point of the spindle then locks the bolt fast, the cam on the

thumb piece at the same time drawing back the cocking piece out of contact with the sear nose and locking the firing pin.

OTHER FEATURES OF INTEREST.

From the general drawing which we have been examining it will be noticed that the mechanism is put together in a rigid manner, and everything is made as safe as possible for the man who uses the gun. The receiver and the one-piece magazine and guard are drawn firmly together by screws from opposite sides of the stock and the thrust on the receiver is taken by the heavy lug near the front end, this lug also forming a stop for the end of the rod bayonet. The latter, by the way, is grooved near its point and again near the middle of its length, and is held either fixed or at rest by a spring catch engaging the grooves. The various parts are of high-grade, tough material, especially the barrel, which has to withstand the severe stresses imposed by the high powder pressure previously noted, and is subjected to wear due to the cupro-nickel jacket with which the bullet is fitted, and to the injurious effects of the smokeless powder.

The barrel has a right-hand twist of one turn in ten inches, the four grooves being .176 wide and .004 inch deep. The rear sight base is formed with two bands encircling the barrel and is put on to stay. The eye-piece, which may be adjusted for lateral deviation of the bullet, carries a peep plate which may be pushed up and used when required, and the front sight is protected when the rifle is not in use by a cover which guards muzzle and sight. The floor plate of the magazine is held in place by a spring catch and may be removed by inserting the tip of a cartridge ball in the opening under this catch and drawing the plate slightly to the rear. The magazine spring may then be slid out of its pockets in both floor plate and follower. Similarly, the extractor is with ease removed from the bolt; it being turned until its tongue is out of the groove in the bolt head and then pushed forward until freed from the engaging lugs on the collar which encircles the bolt. Certain other parts, such as the firing pin, safety lock, etc., may be dismounted with equal facility.

The stock and hand guard are provided with air chambers to reduce the heating effect of the barrel; and the butt is bored from the end to form a pocket for the oiler, which is a tube about six inches long with two compartments, one of which contains oil while the other carries a thong and brush for cleaning the bore of the rifle.

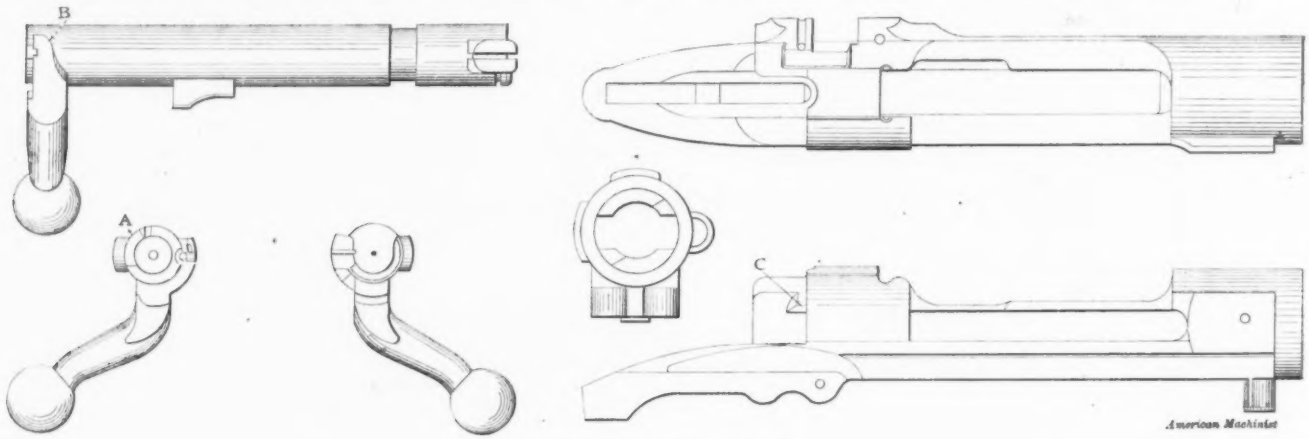


FIG. 56. RECEIVER AND BOLT.

New Trade-Mark Law.

BY GRAFTON L. MC GILL.

Since Thomas Jefferson, as Secretary of State, recommended to Congress in 1791 that the Massachusetts sail-cloth maker be accorded the exclusive privilege of using a particular trade-mark, Congress, up to the present year, has passed but two general trade-mark laws. The first, which was not enacted until August 14, 1876, was declared void by the Supreme Court in the Trade-Mark Cases (100 U. S. 82). The next Act, approved March 3, 1881, provided for the registration of only those marks used on goods in commerce with foreign nations or Indian tribes, with the result that there was no national or Federal recognition of trade-marks used solely in commerce between the States. In consequence, the owner of a mark desiring to gain such advantage as arises from registration, in many instances affixed his mark to a few samples of his goods and shipped them into Canada, or some other foreign country, in order that he might make the showing required under the Act of 1881.

Since the Supreme Court decided in 1888, and again in 1903, that the registration of a trade-mark did not *ipso facto* give the Federal courts jurisdiction over an infringer using the mark in domestic commerce, manufacturers and other owners of trade-marks have been knocking loudly at the doors of Congress for some tangible relief.

Congress has at last responded by the enactment of a law which will be welcomed by all interested in the protection of this valuable asset of industrial property. Indeed the new law is of interest to all owners and users of trade-marks, whether registered or not. The most important provision is that a mark is entitled to registration altho it is used solely in interstate commerce.

The requirement as to the nature of marks that may be registered remains practically as heretofore; but the most important change in this regard is that marks which have been in exclusive use for ten years or more are entitled to registration whether they do or do not fulfill the requirement as to marks in general. This is in keeping with the English statute which accords special privileges to what are termed "old marks."

FEE REDUCED.

It is important to note that the present exorbitant government fee has been reduced to $10. There never has been any reason for imposing a tax of $25 for the mere registration of a trade-mark. A certificate of registration will hereafter be for a term of twenty years, instead of thirty years as heretofore. Other provisions that may be noted are that all marks upon which applications for registration have been favorably passed are to be published in the *Patent Office Gazette* before the certificates are issued, so as to allow of the filing of opposition; certificates granted may be cancelled upon a showing made by anyone injured thereby; appeal may be taken to the Court of Appeals of the District of Columbia, the decision of the Commissioner of Patents being no longer final; and, as in patent cases, writs of certiorari may be granted by the Supreme Court of the United States. The Federal courts are given original jurisdiction of all suits at law or in equity respecting registered trade-marks, regardless of the amount in controversy.

TRADE-MARKS ASSIGNABLE.

Another provision to be noted is that the new Act provides that trade-marks may be assignable, but only in connection with the good will of the business in which the mark is used. In other words, a trade-mark cannot be divorced from the

manufacture in connection with which it has been employed. Hereafter notice of registration must be given on the marks themselves, or in some other suitable way. This provision is modeled on that section of the Patent Law requiring that patented articles be so marked. Indeed it is manifest that the whole Act is drawn on lines closely analogous to the Patent Statutes.

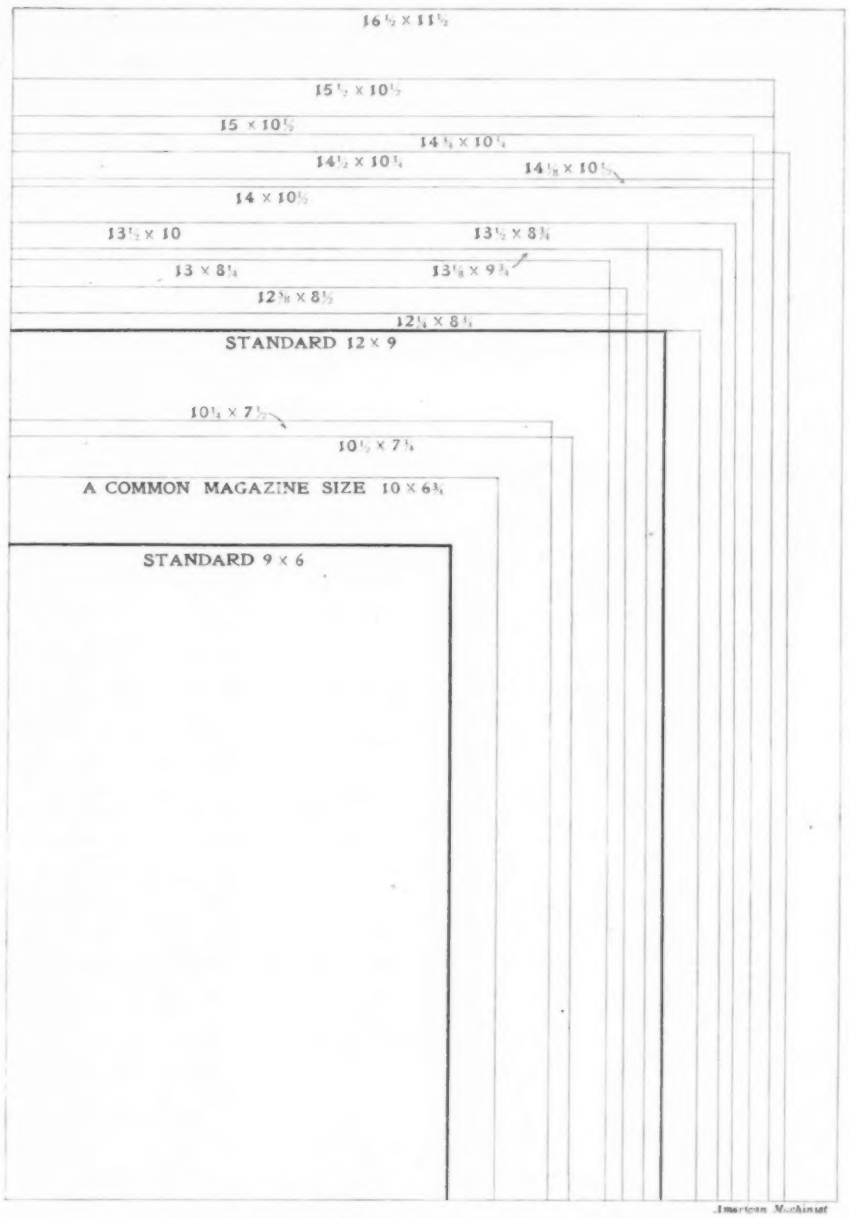
If the interpretation of the Act should tend to hamper rather than to promote the interests of the owners and users of trade-marks there may be cause to regret the failure of Congress to adopt the recommendation of the American Bar Association that the entire subject be transferred to the Department of Commerce and Labor, where it properly belongs.

New York.

The Cooper Hewitt mercury-vapor lamp has already become the standard illuminant for photographic purposes.

Standard Sizes for Periodicals.

We are glad to note that several of our exchanges have recently reduced their page dimensions to the now quite widely adopted standard size of 12x9 inches. One at least had to increase its dimensions to come to the standard. One esteemed technical publication, we regret to say, only came half way, which of course was not coming at all. We have no idea that any of those who have done the right thing in this matter will ever regret it, any more than has the AMERICAN MACHINIST after nine years of experience in the better way. It is not at all worth while for us to go into any argument to induce others to make the change, as we take it that all must see the self-evident advantage of having a common size of page. It is merely the survival of "the thing that is" which prevents the "fittest" from beginning its survival in the individual cases. The size 12x9 inches, or a multiple of it, may not be, and probably is not, the best for the daily newspaper, but the uniform adoption of some size is desirable, and we note that the *New York Times* when it moved into its unique building and installed its new presses announced that it at the same time changed its page size to that of half a dozen other metropolitan dailies.



PAGE DIMENSIONS OF A FEW OF OUR EXCHANGES.

The diagram herewith is offered as a "terrible example" of the heterogeneous conglomeration of page sizes now existent. Here are drawn to the same scale the pages of a number of our exchanges, by no means all of them, and our exchange list is not a large one as those things go. Think of piling these away upon the same shelf. Many of them, which the editors no doubt fondly believe to contain matter worthy of preservation for reference or for record, go ignominiously into the waste basket at once. Office desks and tables are littered with periodicals which refuse to be neatly and symmetrically arranged even temporarily. The post offices are prevented from making arrangements for the handling of newspaper mail with complete and fitting system. Paper makers and printers also are inconvenienced and expenses are involved in the production of periodical technical literature which might easily be avoided. If there is any reason of any kind why anyone should not make his page the same size as any other we have some curiosity to know what the reason is.

The adoption of the 9x6 size of page for the transactions of the technical societies and for pamphlets and books of all kinds has been a great convenience and a promoter of universal comfort. Many of the makers of catalogs of machine tools, steam engines and machinery of all kinds have seen their interest in promoting the handling and preservation of their printed matter for reference by putting it forth in the regular size and shape, but one of the everlasting marvels is that there are so many who have not so "caught on." We could get up a diagram of the sizes in our catalog file which would require vastly more diverse lines and dimensions than those here shown for a few technical periodicals. Printing and distributing catalogs and requiring that they shall not be preserved, which is what is done when they are made of inconvenient size, is one of the most absurd business propositions within our knowledge.

We have noted heretofore that water should not be used in attempts to extinguish oil fires. *Insurance Engineering* in its latest issue gives an account of a fire in a brass foundry in Waterbury, Conn. It says: "A truck loaded with metal slued and the wheel struck a vertical oil pipe, breaking it off. The oil flowed over the iron floor and was ignited by the furnace fire. A hose stream was first turned on by the mill fire department, and then quickly turned off, and sand used to extinguish the fire. The public fire department was called, but its services were not needed."

The Layout and Construction of Cams—II.

BY CHARLES F. SMITH.

Figs. 10 and 11 illustrate face cams giving uniform motions, the former operating a roller mounted upon a slide and the latter upon a radius arm. As before said, these forms should be avoided, except of course when the motion required is such as to necessitate their use. They are sometimes used in combination with crank-motion forms, the crank motion being used to bring the parts to speed and also to bring them to a stop. An example of this will be given later.

TWO-STEP CAMS.

Fig. 12 illustrates the laying out of a face cam to give a movement in two steps, each step being taken with a true crank motion. The driven crank arm is centered at A, its extreme positions being B and C with an intermediate dwell at D. The first movement is from B to D and the second from D to C. The cam roller is carried by an arm pivoted to the end of the crank arm and having a forked end which straddles a square guide block which rides on the shaft. A construction of this kind is shown in Fig. 2 at the left of the bevel gears in the middle of the front side of the chain machine.

The extreme throw is laid out on the horizontal center line and the lines B and C are drawn from A to give the same movement on each side of the vertical center line. The arc $E F$ is drawn and the position D of the arm at the intermediate dwell is laid down. Chords $G H$ are drawn and on them throw circles are drawn each of which is divided into parts as before, the division points being projected to the arc $E F$. The extreme positions of the arm which carries the roller are drawn in at I and J. The extreme positions of the roller are at K and L, and an arc $K L$ tangent to J will give approximately the path of the roller which may thus be treated as tho pivoted at the center M of the arc $K L$, which does not conform to the recommendation that it should pass thru the center of the cam shaft, as it is impossible to make it so conform. With radius F o K and centers at the points of the arc $E F$ projected from the division points of the throw circle on chord G, the positions of the circles 0, 1, 2, 3, etc., from the cam-shaft center are obtained and they are drawn. Points $P Q$ are found on the arc $M N$ from which to strike arcs 0 a and 12 a to include the angle of movement of the cam within which the first movement of the roller is to take place, and the arc $P Q$ is then divided as before and arcs 1 a, 2 a, 3 a, etc., are drawn, the intersections of which with the correspondingly numbered circles, drawn from the cam-shaft center give the outline of the center line of the cam for the first movement.

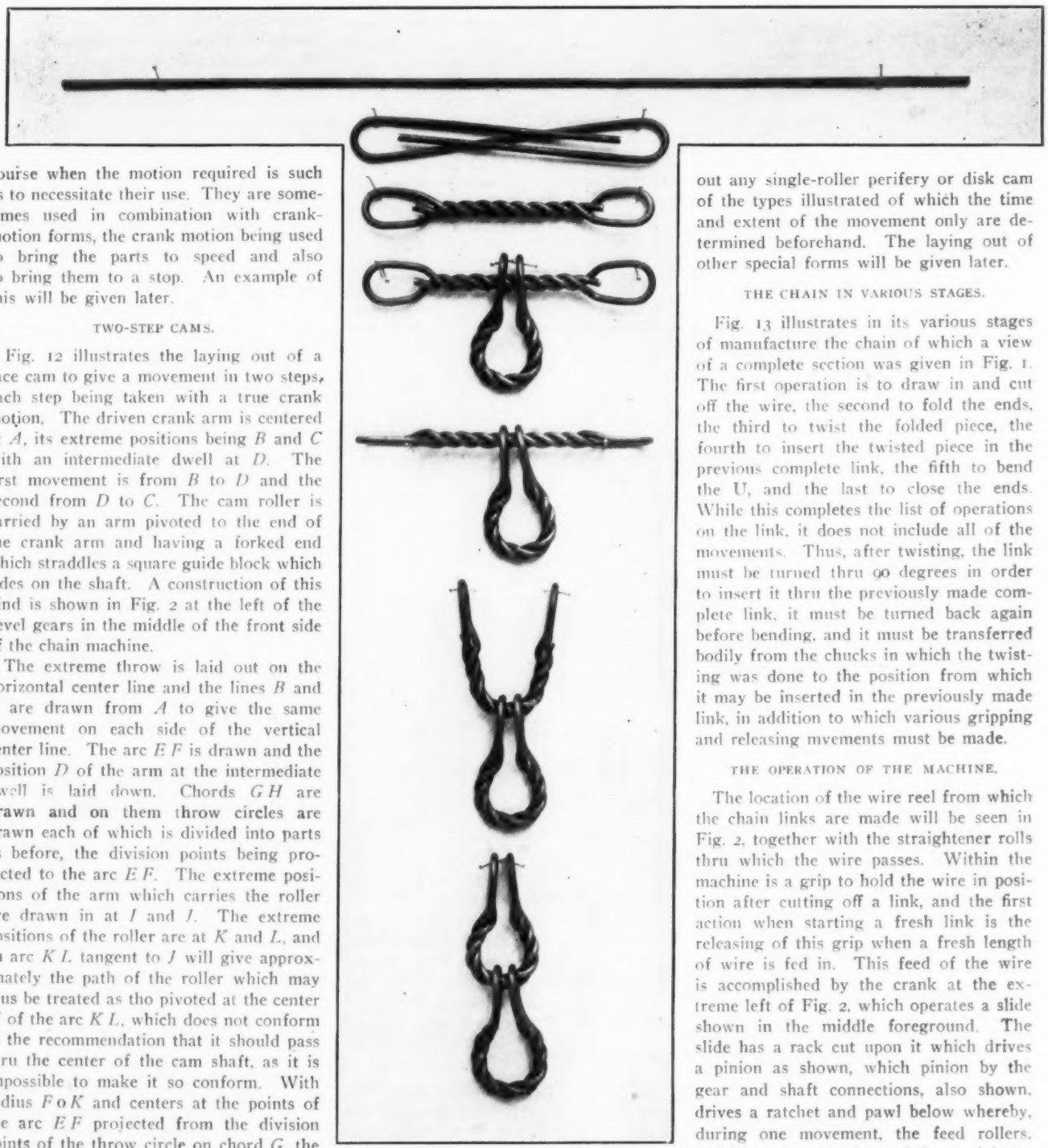


FIG. 13. CHAIN LINKS IN SUCCESSIVE STAGES.

The required length of dwell $R S$, for which the cam curve is of course a circle, is then laid out and the profile for the second movement is then determined in the same way from the throw circle drawn on chord H, but of this details need not be given. The inevitable limiting angle of 30 degrees appears in both cases.

The return movement, not shown, is laid out from a third throw circle of which the diameter is equal to the sum of those already used.

The above methods are sufficient to lay out any single-roller perifery or disk cam of the types illustrated of which the time and extent of the movement only are determined beforehand. The laying out of other special forms will be given later.

THE CHAIN IN VARIOUS STAGES.

Fig. 13 illustrates in its various stages of manufacture the chain of which a view of a complete section was given in Fig. 1. The first operation is to draw in and cut off the wire, the second to fold the ends, the third to twist the folded piece, the fourth to insert the twisted piece in the previous complete link, the fifth to bend the U, and the last to close the ends. While this completes the list of operations on the link, it does not include all of the movements. Thus, after twisting, the link must be turned thru 90 degrees in order to insert it thru the previously made complete link, it must be turned back again before bending, and it must be transferred bodily from the chucks in which the twisting was done to the position from which it may be inserted in the previously made link, in addition to which various gripping and releasing movements must be made.

THE OPERATION OF THE MACHINE.

The location of the wire reel from which the chain links are made will be seen in Fig. 2, together with the straightener rolls thru which the wire passes. Within the machine is a grip to hold the wire in position after cutting off a link, and the first action when starting a fresh link is the releasing of this grip when a fresh length of wire is fed in. This feed of the wire is accomplished by the crank at the extreme left of Fig. 2, which operates a slide shown in the middle foreground. The slide has a rack cut upon it which drives a pinion as shown, which pinion by the gear and shaft connections, also shown, drives a ratchet and pawl below whereby, during one movement, the feed rollers, which are seen just beyond the straightening rolls, are turned and the wire fed in, while during the return motion of the slide the feed rolls stand still. The ratchet is fitted with differential pawls which give sufficient accuracy.

A crank was adopted for the initial movement because, there being no move-

ment behind it, there is ample time for the work to be done.

Figs. 14 to 17 give bird's-eye views of the operations on the piece subsequent to cutting off. In the background of Fig. 14 the wire is seen passing at a slight angle thru the bending chucks and gripped by a second grip, called plyers, between the chucks. Fig. 15 shows the same wire partially bent to the shape of the second illustration of Fig. 13. Fig. 16 shows it after being stripped from the plugs over which it was bent and transferred to the twisting jaws which have partially twisted it. After twisting the double disk transfer chuck which is seen edgewise in all the views, moves up to the twisted wire, grasps it in one of its four jaws, withdraws it, and in two steps turns half over and then moves toward the observer and presents the wire to the chuck seen in the immediate left foreground of Fig. 16. This second chuck then advances and grasps the twisted link, as also seen in Fig. 16, when the disk chuck withdraws, as seen in Fig. 17, the second chuck turns the link thru 90 degrees, as seen in Fig. 14, and advances it thru the previously bent link, as seen in Fig. 15, when it turns the link back thru 90 degrees and a third

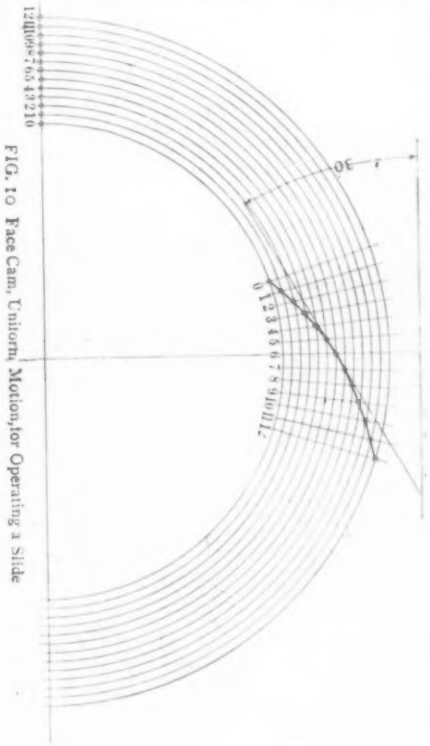
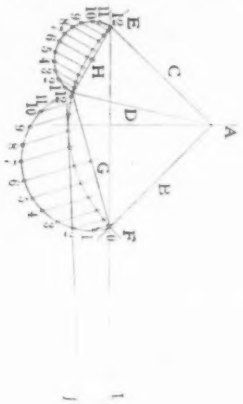


FIG. 10 Face Cam, Uniform Motion, for Operating a Slide



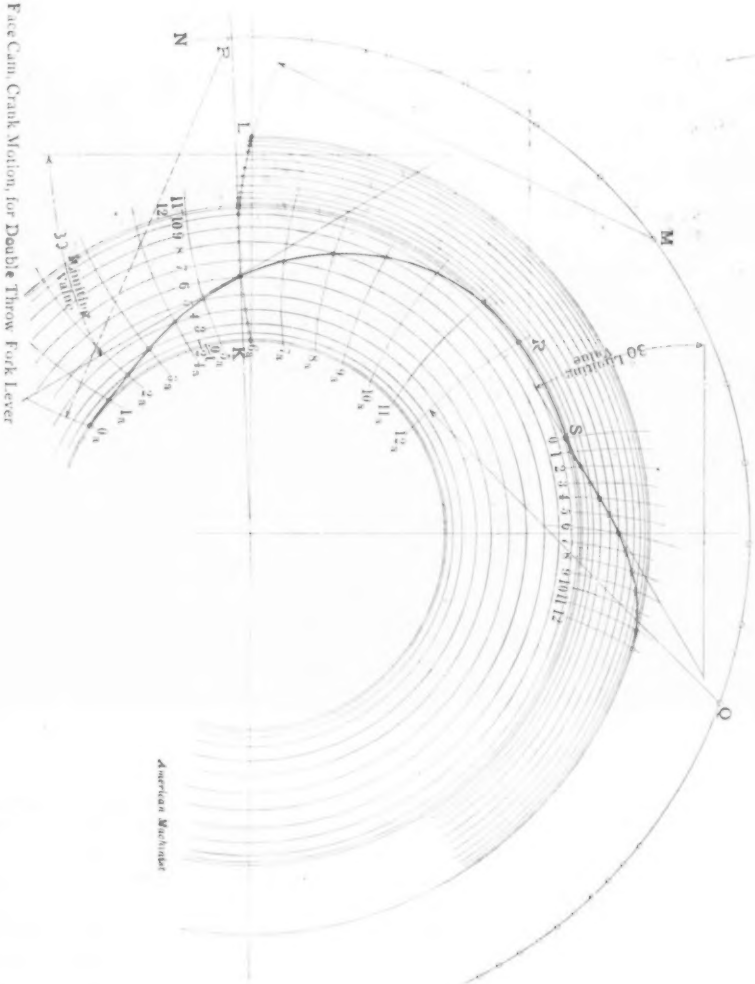


FIG. 12 Face Cam, Crank Motion, for Double Throw Fork Lever

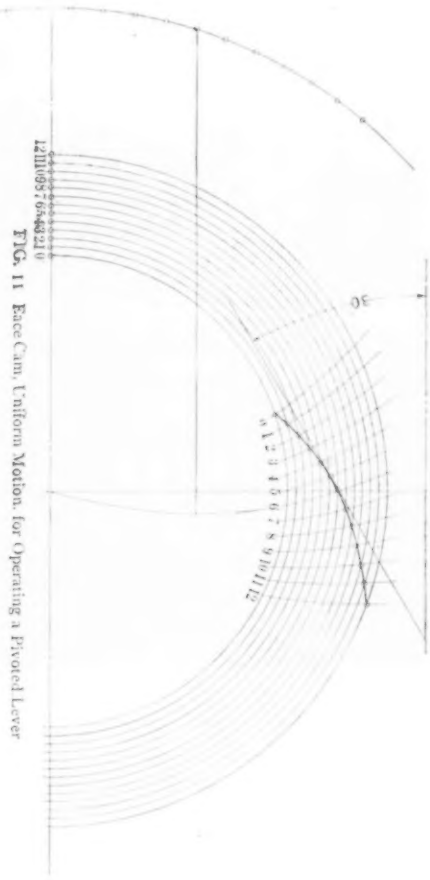


FIG. 11 Face Cam, Uniform Motion, for Operating a Pivoted Lever

chuck at right angles to the second takes possession and the link is bent to the U form, as seen in Fig. 17, and lastly, the link ends are closed—an operation which is not shown in the illustrations.

CHARTING THE MOVEMENTS.

The complete chart for the machine is shown in Fig. 18. The base line is divided into five degree intervals and a zero line common to all the movements is drawn at the left, the cams being treated initially as tho all rollers were upon the same line and thus had a common zero, as this facilitates comparing the different movements and adjusting them to one another. The curves of the chart have all been developed by throw circles and radius arms drawn upon it and then erased and thus give the correct movements of the rollers and profiles of the cams except that they were all treated as tho of the perifery style. The use of the constants which have been given is to prevent repetition of the work of laying out the curves, as they enable us to determine if the angles of the curves do not exceed the 30-degree limit without drawing them. The true curves should be laid out in all cases. As the work goes on it will often be found that while there is ample time for some of the movements there is scant time for others, and it will frequently be found difficult to get all of the movements in a single revolution. Adjustments will thus be found necessary, some of the movements being begun before the previous ones are completed, and in order to make such adjustments the true movements must be charted. The return movements are in some cases prescribed by the conditions of the work, while in others the designer is at liberty to make them take place at pleasure. They are to be laid out in the same manner and with the same limitation as to angle as the acting movement.

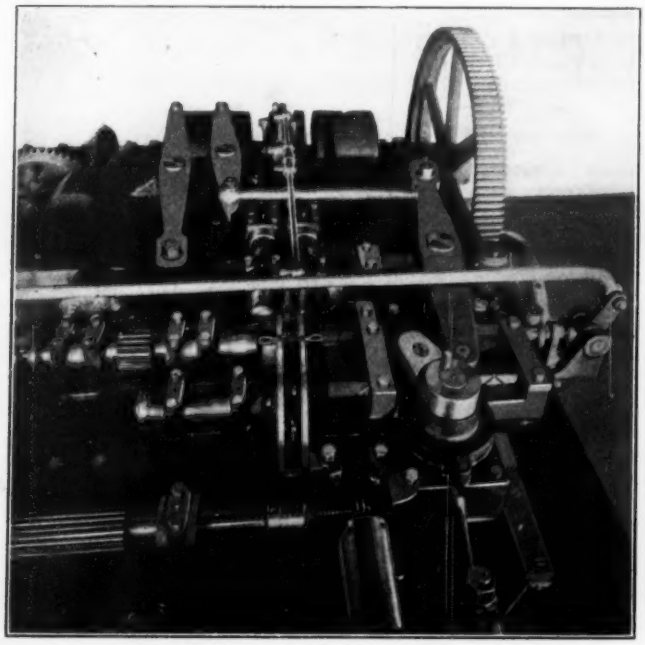


FIG. 14.

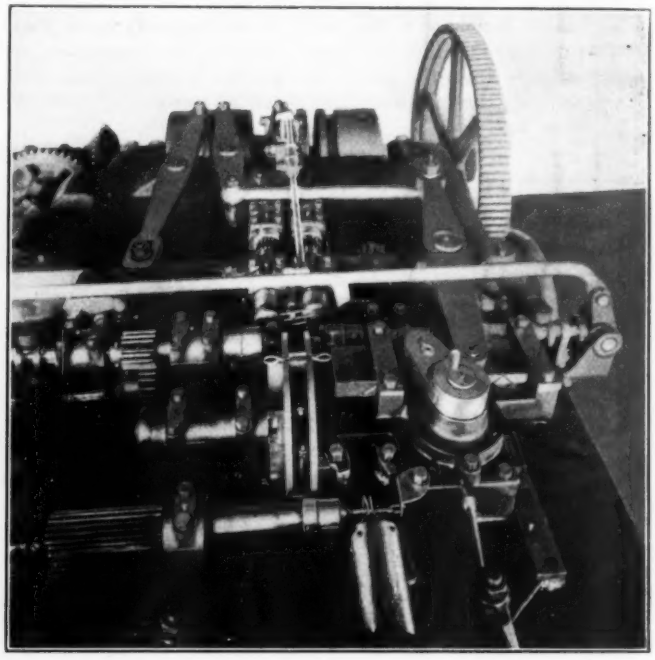


FIG. 15.

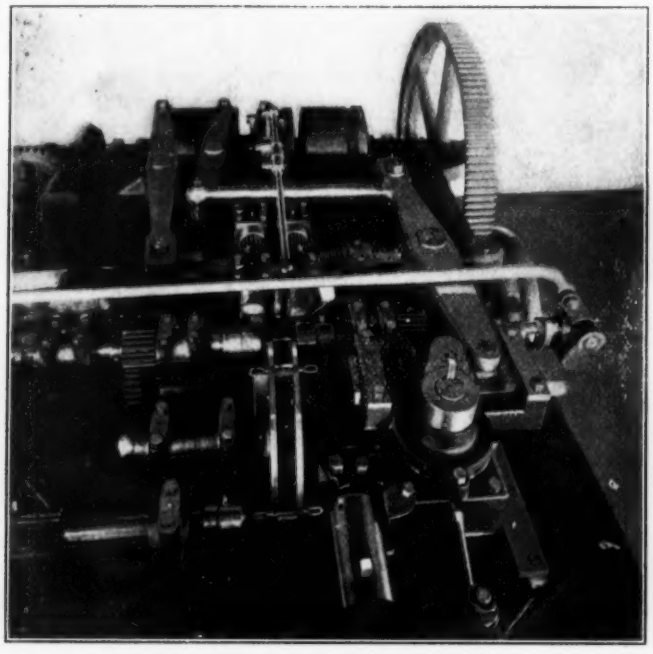


FIG. 16.

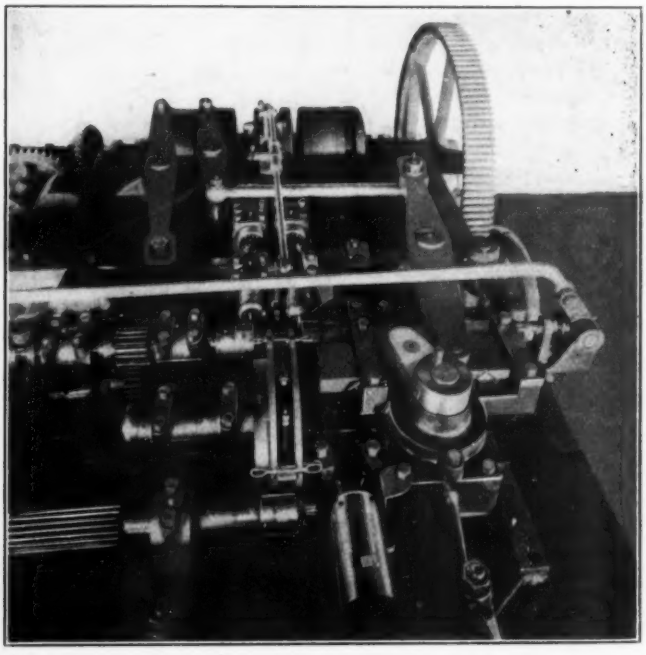
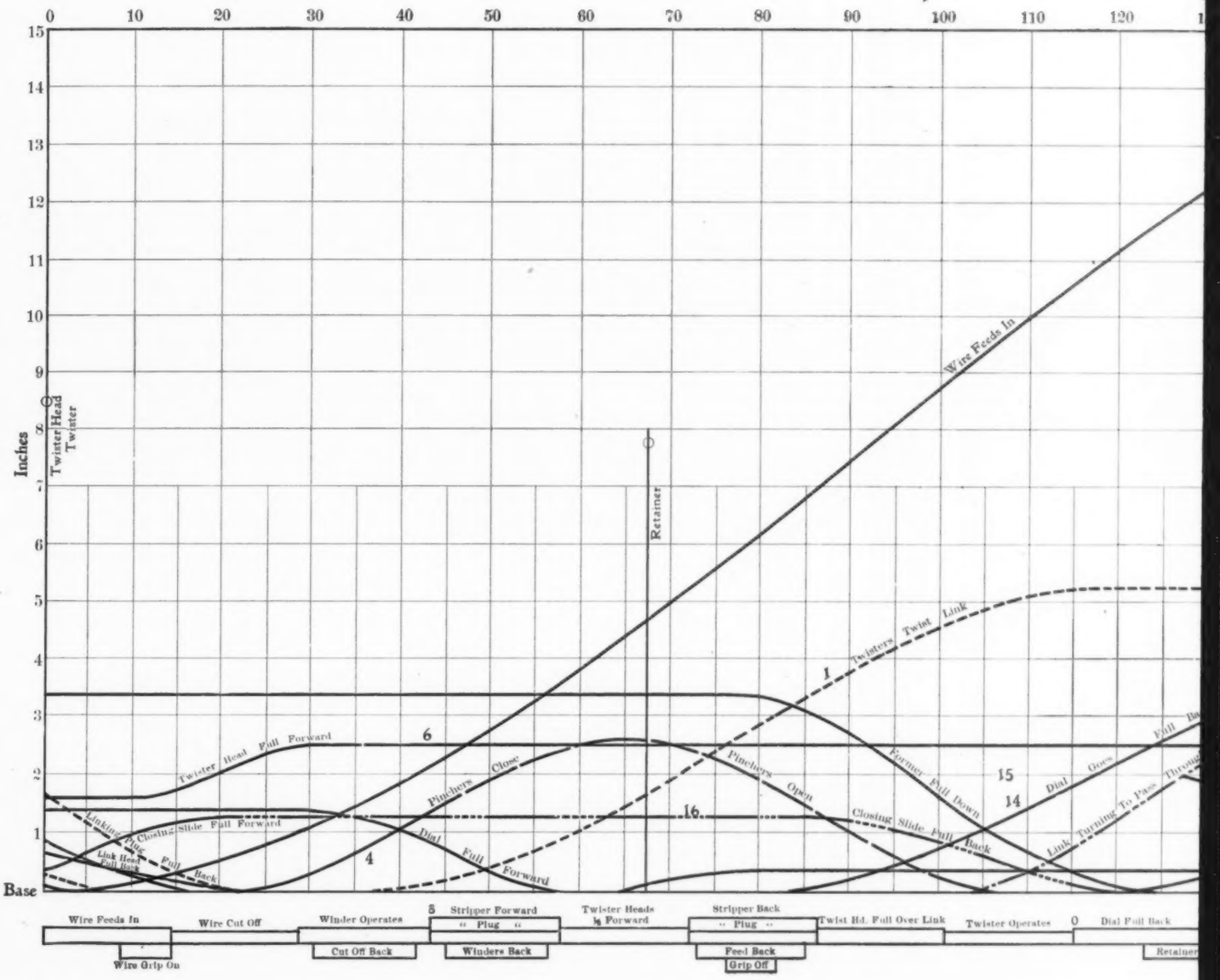


FIG. 17.


0 10 20 30 40 50 60 70 80 90 100 110 120
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
Inches
Base
Twister Head Twister
Retainer
Wire Feeds In
Twisters Twist Link
Twister Head Full Forward
Pinchers Close
Pinchers Open
Former Full Down
Dial Goes
Link Turning To Pass
Linking Slide Closing
Slide Full Forward
Link Head Full Back
Dial Full Forward
Closing Slide Full Back
1
4
6
14
15
16
Wire Feeds In
Wire Cut Off
Winder Operates
Stripper Forward
" Plug "
Twister Heads ½ Forward
Stripper Back
" Plug "
Twist Hd. Full Over Link
Twister Operates
Dial Full Back
Wire Grip On
Cut Off Back
Winders Back
Feed Back
Grip Off
Retainer

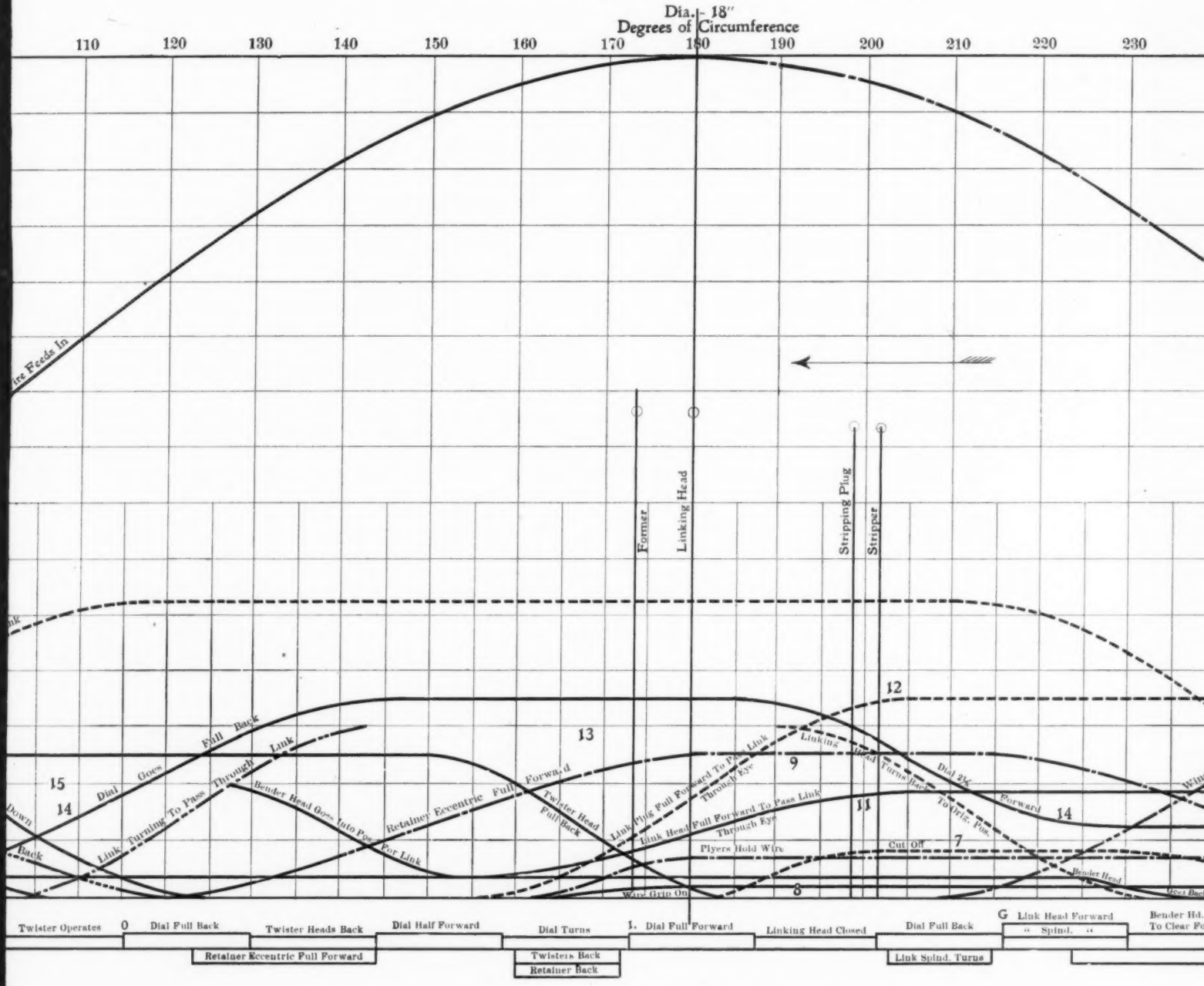
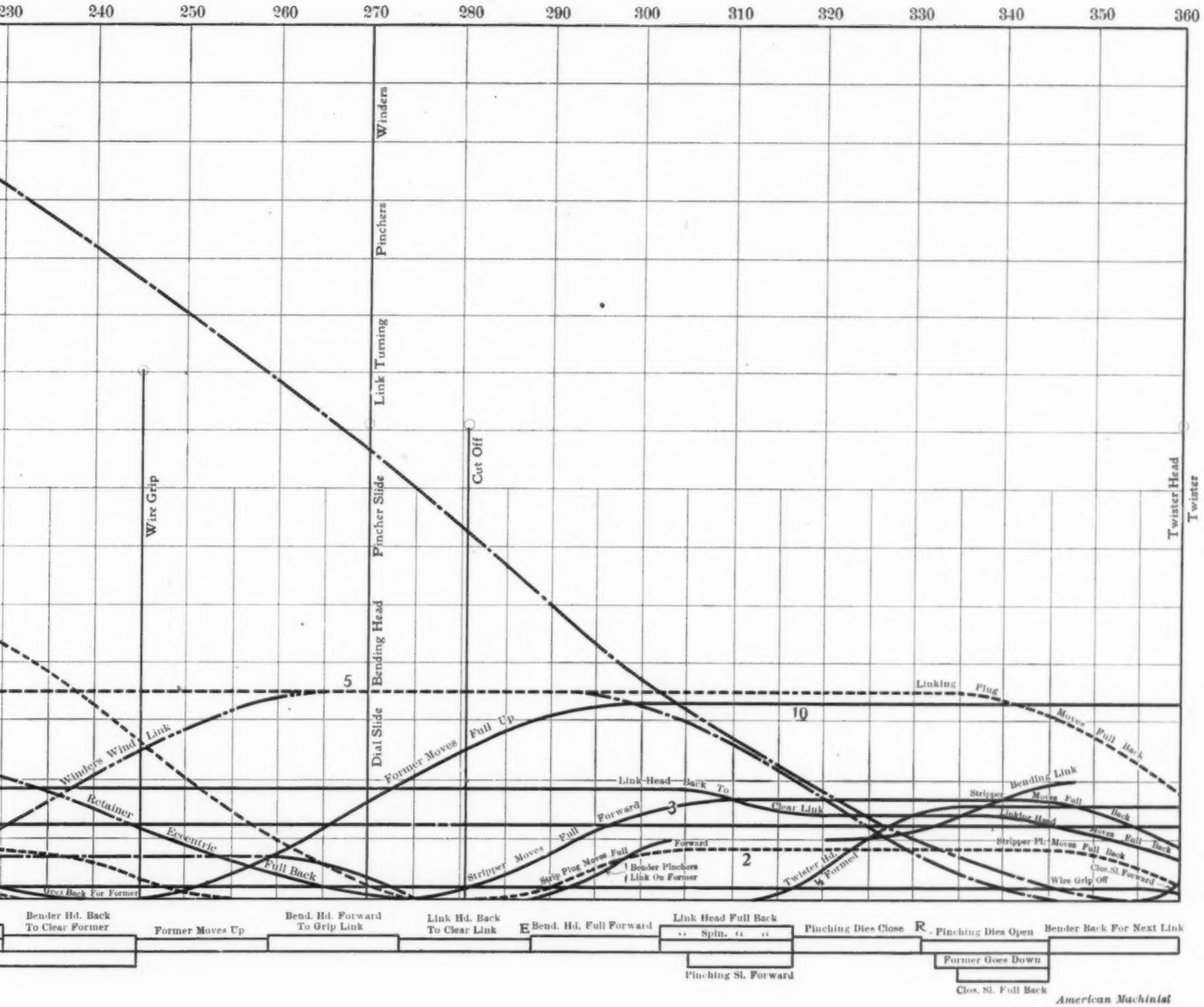


FIG. 18. CAM-CHART OF CHAIN MACHINE.


230
240
250
260
270
280
290
300
310
320
330
340
350
360
Winders
Pinchers
Link Turning
Pincher Slide
Bending Head
Dial Slide
Wire Grip
Cut Off
Twister Head
Twister
5
10
3
2
Linking Plug Moves Full Back
Former Moves Full Up
Winders Wind Link
Retainer
Eccentric
Full Back
Link Head Back To Clear Link
Forward
Stripper Moves Full Forward
Strip Plug Moves Full Forward
Bender Pinchers
Link On Former
Twister Head To Former
Bending Link
Stripper Moves Full Back
Linking Head Moves Full Back
Stripper Pl. Moves Full Back
Clos. Sl. Forward
Wire Grip Off
Bender Hd. Back To Clear Former
Former Moves Up
Bend. Hd. Forward To Grip Link
Link Hd. Back To Clear Link
E Bend. Hd. Full Forward
Link Head Full Back
" Spin. " "
Pinching Sl. Forward
Pinching Dies Close
R Pinching Dies Open
Bender Back For Next Link
Former Goes Down
Clos. Sl. Full Back
American Machinist

The construction of such a chart consumes a good deal of time, but it is time well spent. The chart here shown, counting from the time when the operations and movements had been schemed, consumed about three weeks.

Below the base line will be seen a series of notes which are the first things made after the operations on and the movements of the piece of work have been determined. Their lengths are not to scale and represent nothing, the only purpose of the entries and their accompanying lines being to show the order in which the operations are to take place, together with the places where the movements overlap and favorable places for the return movements to be made. The curved lines of the cam movements are numbered, but this numbering relates to the positions of the cams in the machine and not to their operations, the first cam on a cam shaft being numbered 1, the next 2, and so on. This numbering is carried all thru the drawings of the cams and their templets and formers, and also appears on the cams themselves and the assembly drawing, thus serving to locate and identify each one at all stages of the work.

Referring to the chart, the movement of the feed rolls is shown by the upper curve marked *wire feeds in*. The extreme hight of this curve is equal to the length of wire fed in and at all points of the curve the hight above the base line gives the extent of the movement made at those points.

The starting point of this curve is made the zero line of the chart, the entire length of the chart representing the assumed circumference of the cams which must be assumed at the start, but which is, of course, subject to modification.

The assumption of a common zero line for all the cams is equivalent to the assumption that all the rollers will lie on a line parallel with the shaft as those in the foreground of Fig. 2 in fact do. Other cams, however, have their rollers located on their sides or bottoms or at various angles, and such a disposition of a roller shifts the zero of its cam by the angle by which the roller is displaced from the assumed zero, and this must be taken care of when laying out the actual cam and locating its keyseat, as will be explained later. The assumption of a common zero when laying out the chart simplifies the work in large degree. The angles of displacement of the different cams are, of course, determined from the positions of the rollers given on the general design of the machine and are later on noted on the chart by the various verticals marked *retainer, former, linking head,* etc. As a matter of fact, in the chain machine, but one cam has its zero to correspond with the chart.

After the wire is fed in the next movement is to retighten the wire grip, which is indicated by the lowest cam line of the chart marked 8 and also by *wire grip on*, which shows by its location that the movement of the gripping cam is completed just as the movement of the wire into the machine is finished. Tracing this line to the right, we find it to be straight, indicating that the grip is held closed until near the end of the chart, when the dropping of the line at the note *wire grip off* shows that the grip is loosened just as the next movement of the wire into the machine begins.

Simultaneously with the tightening of this grip the second grip called *plyers* in the chart and shown between the bending chucks in Fig. 14 must be tightened in order to retain control of the cut-off piece, and this is done as indicated on the chart by the line *plyers hold wire*. At the completion of this movement the first operation on the wire—cutting it off—is made as shown by line 7 *cut off*. The hight of this line above the base line, like that of all the others, shows the actual movement of the cam roller, in this case 7/8 inch, which is reduced by a lever to 1/8 inch at the nipper jaw.

The throws of all the cams are obtained in this way by working backward from the movement of the operating point thru the levers and other connections to the rollers and the laying out of the chart then consists in giving to each cam its required extent of movement and in making it begin and end this movement at the right time. The movements are individually simple, being the simple shifting of a lever, the precaution being always observed that the cams are of such size that the most abrupt movement does not involve a steeper angle than 30 degrees. The laying out of cams thus becomes a matter entirely separate from and subsequent to the design of the machine as a whole. The operating parts and their movements and the location of the cam shaft being determined and the connecting levers laid down, the matter, so far as it relates to individual cams, reduces itself to the moving of these levers at the right time and by the right amount. The chart deals with these movements only without regard to their direction or the connecting mechanism.

The next operation is the bending of the link into the form shown in the second view, counting from the top of Fig. 13 and in the act of being done in Fig. 15, and this is done as shown in the chart by line 5 *winders wind link*, the word winder being used for this operation because bender is used for the binding of the link into U shape, as shown by line 15 *bending link*, the number being at the left and the words at the extreme right of the chart.

It would be tedious and unnecessary to trace thru all of the motions in detail, but to avoid confusion it should be noted that in the present machine two revolutions are required to complete a link and the chart thus represents two revolutions, the first revolution completing the bending of the link into the form shown by the second view of Fig. 13, and also getting the twister jaws into position for twisting. A length of wire is fed in and a link is completed at each revolution, the machine operating on two links at all times.

In the next article the laying out of one of the cams in detail and the transfer of its profile to the templet and former and the milling of the cam groove in the milling machine will be taken up.

The Bicycle Eye Cure.

An incident narrated in a recent issue of *The Bicycling World* carries a suggestion worth at least considering, if not of acting upon, by many a man who is experiencing the effects of close application to business. John F. Alvord, president of the Standard Spoke & Nipple Company, and prominent in other concerns in the Naugatuck Valley in Connecticut, was having trouble with his eyes and consulted an eminent New York oculist. After a thorough examination the oculist talked to him as follows:

"Organically there is nothing whatever the matter with your eyes. I could drop a lot of liquid stuff into them, and as it probably would do you no good I can only prescribe the most obvious remedy: Wear glasses for a while. They will afford you some relief, but as a matter of fact the trouble is not with your eyes. It arises from a run-down physical condition, and if you want the best remedy for that state of health, buy a bicycle and ride it. I mean it," he said, earnestly. "I know that the bicycle is no longer fashionable, but that does not affect its benefits. It's the best thing for what's the matter with half of mankind, and if they but realized it, most of those who dropped it at the behest of fashion, dropped the very tonic that they most require. I know. I practise what I preach. I ride a bicycle, and ride it regularly and rationally, and tho I am sometimes derided for doing so, it does not affect my use of it a particle. I know the physical benefits it confers. If you would have your eyes cease bothering you, I say again and in all seriousness, ride a bicycle."

In Golden Gate Park, San Francisco, there has been installed a large windmill of the familiar old Dutch type for pumping water. With the wind at 10 miles an hour it develops 4.65 horse-power, and at 30 miles an hour the horse-power is 126. Its daily pumping record in June, 1904, ranged from 5,460 gallons to 371,397 gallons against a gage pressure sometimes of 32 pounds and sometimes of 53 pounds.

"The best testimonial I ever saw," he said, "contained exactly fifteen words. It read: 'Worked for us four years at $50 a week. Wish we could have him back.' If employers would give letters like that to men who have proved capable and trustworthy, and make a rule never to give a letter of any kind to an incompetent man, it would be better for both employer and employee."—*Woodworker*.

The "Simplex" Watchman's Recorder.

This recorder, of which two sizes are shown in Figs. 1 and 2, is designed for keeping a record of the movements of any number of watchmen about a machine or other plant, and contains certain novel features which permit the use of a straight-ruled rectangular record sheet. The recorder is located in the office or at some central point and connected by wires with the watchman's stations

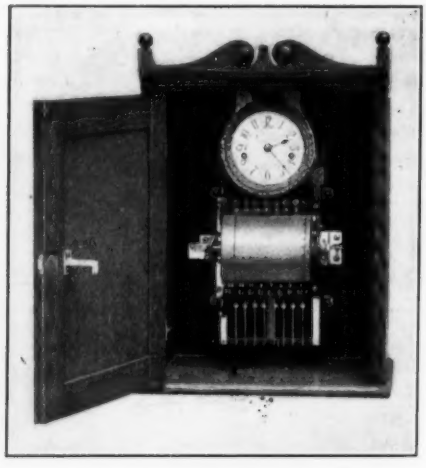


FIG. 1. WATCHMAN'S RECORDER FOR 25 STATIONS.

throughout the establishment. It contains a record sheet on a drum rotated by clockwork, and is equipped with any required number of recording points with their levers and magnets which are actuated by a current from their respective stations, each station consisting of a small magneto generator which is securely boxed and which is operated by means of a crank key carried by the watchman. This key is used at all stations, and when the armature shaft at any station is given one or two turns a current is sent thru the corresponding magnet in the recorder and the magnet then attracts its lever and forces the recording pin thru the record sheet, thus showing the time at which the station was visited.

As will be seen from the sheet reproduced about one-third size in Fig. 3, actual size 5x13 inches, the time is shown by straight vertical lines ruled in ten-minute divisions; the record from each station appearing in a separate horizontal space. The sheet is ruled for twenty-four hours, leaving no possibility of confusing the first trip at night with the last trip in the morning. This ruling also permits the day watchman to register on Sundays or holidays, and, by starting the trips a few minutes later the second night, a distinct record can be kept for two nights and the intervening days without changing the sheets.

The sheet shown gives the record of one watchman covering a fifteen-station route every hour from 6 P. M. to 5.30 A. M., with a half-hour's rest at midnight. The black dots represent the perforations in the actual record, and it will be seen at a glance that the watchman failed to register from box No. 7 on his 12 o'clock trip. It will be noticed also that half of the sheet is free for the record of the day

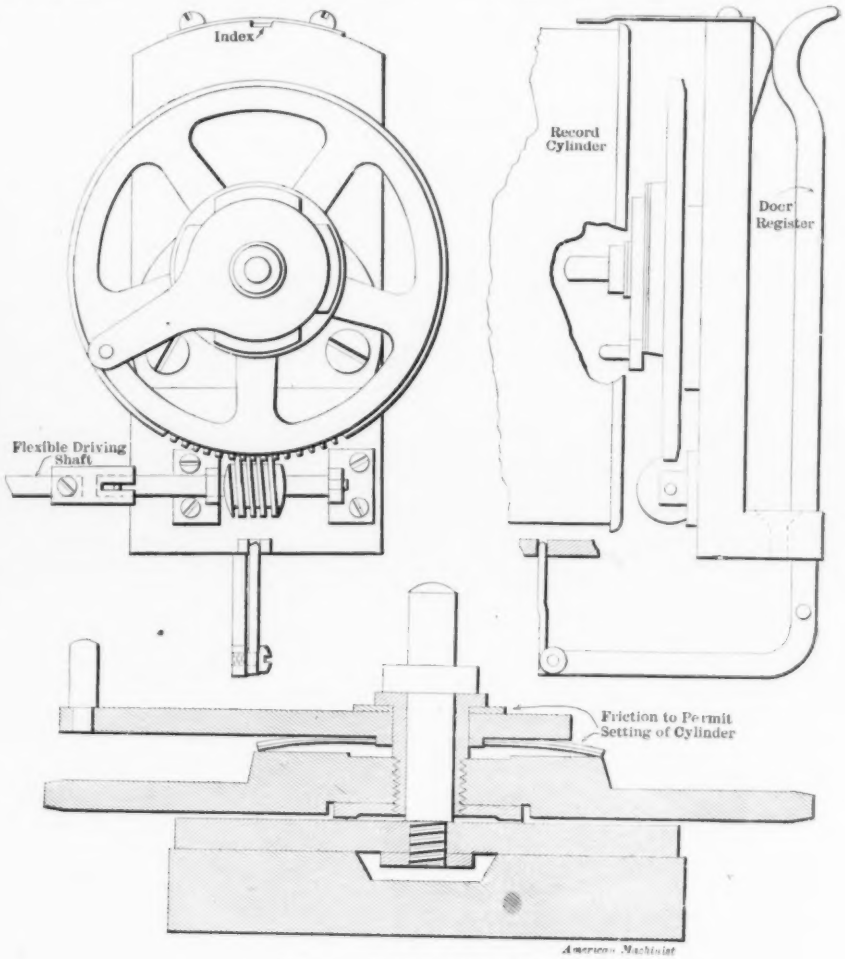


FIG. 4. DRIVING MECHANISM.

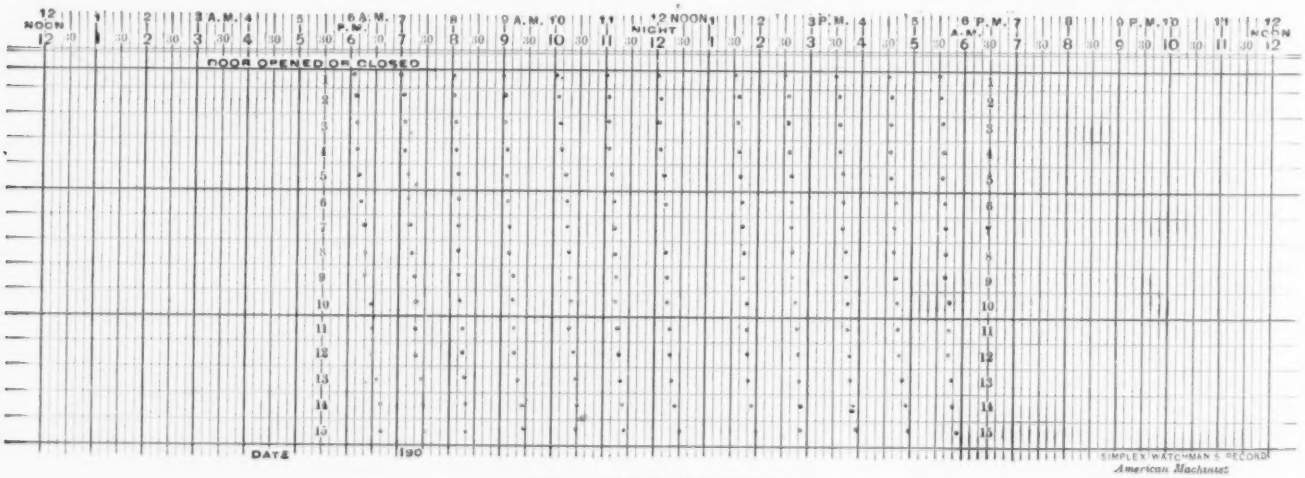


FIG. 3. THE RECORD SHEET.

watchman. The door record near the top shows that the recorder was opened to put on or remove the sheet at 7.30 A. M. and at 8.10 A. M., and at no other time. This door record makes it impossible for the watchman or any other person to open the case and tamper with the record without detection.

The record sheet is fastened around a grooved hard-rubber cylinder which makes one turn in twenty-four hours. An eight-day Seth Thomas movement, with jeweled escapement, transmits power thru a simple gear connection and a flexible shaft to the worm and gear which rotate the cylinder. This driving mechanism is shown in Fig. 4, the detail at the bottom to larger scale showing the friction arrangement which connects the cylinder or drum to the driving gear and yet allows it to be readily set.

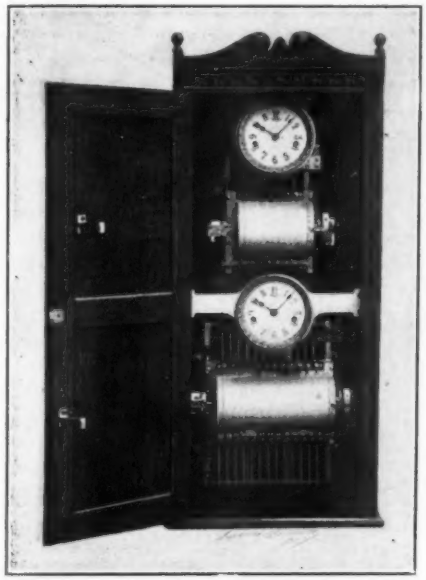


FIG. 2. WATCHMAN'S RECORDER FOR 50 STATIONS.

The worm gearing is illustrated also in Fig. 5, which represents the iron frame for carrying the cylinder and recording apparatus, with the grooved cylinder and magnets at either side. The magnets are mounted in pairs upon two heavy brass plates, either of which can be taken out by removing four screws, and all working parts are easily gotten at.

As will be seen from Fig. 6, the recording mechanism is exceedingly simple. The armature levers are straight, and the prick-pins are hinged directly upon them, there being no intermediate parts. The direct pull of the magnet forces the point of the pin thru the paper and the lever is returned to its inoperative position by gravity assisted by a light steel spring easily adjustable for any required pressure. The perforating points are conical and provided with collars at a fixed distance from the end. The collars strike the ribs between the grooves of the cylinder and prevent breaking the paper or unduly enlarging the perforation by continued or rapid turning of the station magnetos. The points are ground and plated, and the conical shape prevents their sticking in the paper or tearing the record.

The method of wiring is that common to all magneto systems, using a separate wire from the recorder to each station, and a common return wire from all stations. The fact that there are no batteries prevents short-circuiting of distant stations at a point near the recorder and adds to the protection afforded by the door record referred to above. The use of cabled wires furnishes still further protection against possible fraud and is recommended where plants are widely scattered or special precaution desirable.

Recorders of the type shown in Fig. 1 are made to receive the records from any desired number of stations up to twenty-five. A smaller one is constructed on similar lines for up to fifteen stations. The one in Fig. 2 is a fifty-station affair. For plants requiring more than that number of stations the clocks are arranged in two or more cases.

The manufacturer is the Simplex Time Recorder Company, Gardner, Mass.

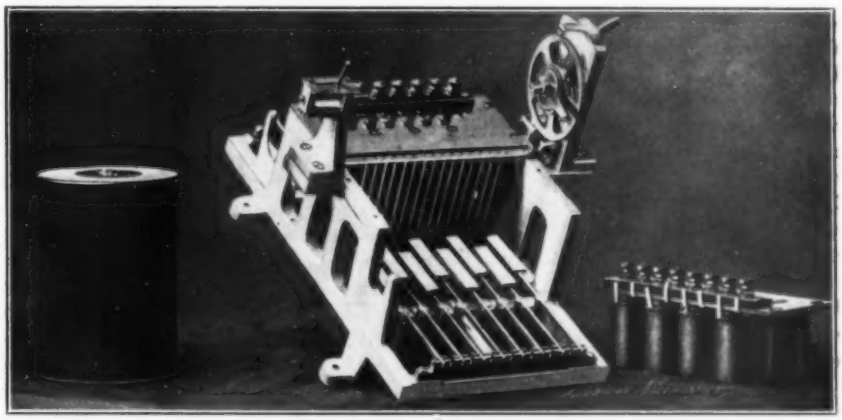


FIG. 5. RECORDING MECHANISM.

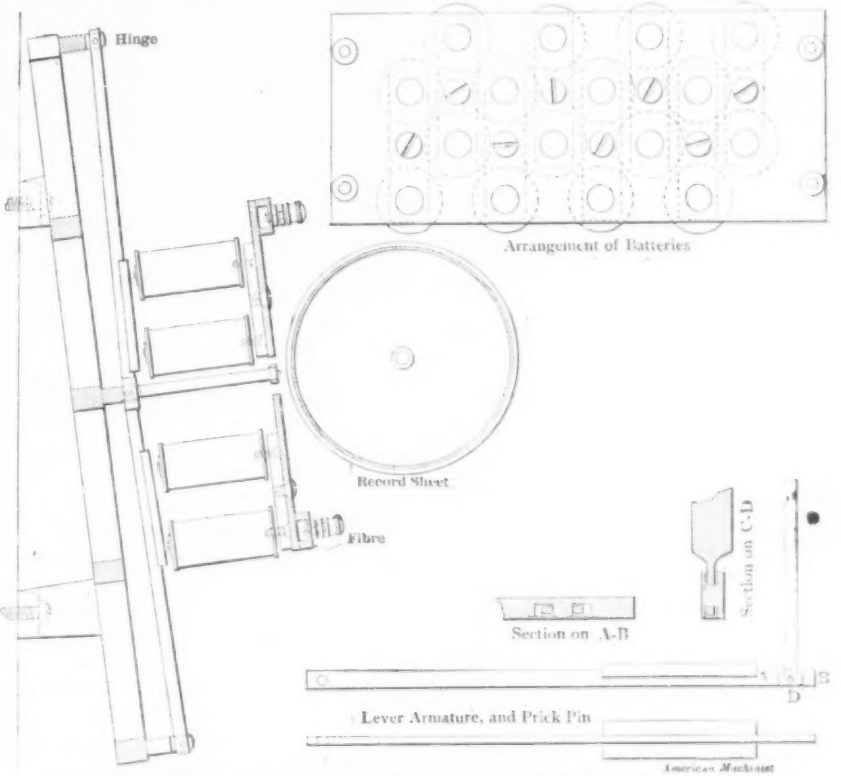


FIG. 6. VERTICAL SECTION THRU RECORDER WITH SOME ENLARGED DETAILS.

Notes on Concrete Foundations.

BY A. D. WILLIAMS.

Concrete is very largely used at present for machine foundations. It is a little heavier than brick, but not quite as heavy as stone. By the use of forms it can be molded into any desired shape and a monolithic or sectional block can be made. Concrete is composed of cement and sand mixed with either cinders, gravel or crushed stone, or any two or all three of the last ingredients may be used. For machine foundations where weight is desired, the last two mentioned are usually employed.

TESTING CEMENT.

A good slow-setting Portland cement should be used for important foundations. For a great deal of work where only small quantities are involved, the mill tests which are supplied with each shipment can be accepted. It is comparatively easy to check the tests for soundness and time of initial and final set, without any expensive apparatus. Samples of cement are taken from different packages and mixed. A portion of the mixture is mixed for four or five minutes with just sufficient water to make a stiff plastic mortar, and four or five pats are made, about 2½ to 3 inches in diameter, ½ inch thick at the center, with thin edges. The pats are made on glass plates. The time is measured from the time of adding the water. The initial set is determined when the cement will bear a wire 1-12 inch in diameter, loaded with 4 ounces, and should not take place in less than thirty minutes, and in first-class cements it does not occur for at least sixty minutes. The final set is when the cement will bear a wire 1-24 inch in diameter loaded with 16 ounces, and this should occur inside of eight hours. The test for soundness is a pat, allowed to stand in air till final set has occurred, then immersed in water at ordinary temperature for four weeks. During this time it should show no signs of warping or cracking and should adhere tightly to the glass. A pat allowed to stand in air should show a uniform color, without blotches of any kind, and should adhere to the glass.

A hot test can be made on a pat twenty-four hours old by placing the plate of glass with the pat down on top of a tin pail partially full of cold water, which is then slowly raised to the boiling point. This pat should be exposed to the steam several hours and should remain fast to the glass, without cracking or warping. The fineness can be tested by using a sieve made of 40-gage Stubs wire having 100 meshes per inch (10,000 per square inch). Ninety per cent. of the cement should pass. If more detailed tests are required, samples can be sent to firms making a business of such work, and this is advisable where the quantity of cement used is large but not enough to warrant the installation of the testing equipment requisite.

The sand should be clean, coarse and sharp and can be tested by the hand. A portion of it rubbed in the hand should leave very little dirt. Its sharpness will be evident to the touch, and it should have a tendency to fall apart, and not pack, when pressed together.

The water used should be clean, free from sewage, and is usually drawn from the public supply, where such is available.

The stone or gravel should pass thru a 2-inch screen over a ¼-inch screen, and neither tailings nor fines should be used in the concrete. Broken stone is usually considered a little better than gravel, as it presents a rougher surface to which the cement will knit better. Practically the difference, if any, is too slight to notice. The stone should be hard. Hard limestone is good, except when the concrete is to be used around furnaces or stacks, where it is liable to get hot. Long-continued heat will gradually burn the limestone, and it will slack when dampness gets to it, as it ultimately will, and cause trouble.

THE FORMS.

Form lumber should be dressed on one side and be at least 1 to 2 inches thick. The thinner lumber requires more bracing, and the total amount of material used is about a stand-off. The aim is to secure a true, flat surface, free from waves, and this means that the bracing must be spaced closely enough to prevent bulging. The spacing also depends upon the depth of concrete to be deposited at one time. In building walls the two sides of the form can be tied together by bolts, which are afterward cut off flush with the face of the wall. Where rust stains must be avoided the bolts can pass thru sleeves made of small tile pipe. This will permit removing the bolt, and the tile can be broken back from the surface and the opening plugged with cement mortar, or, if desired, the opening can be left for a "weep hole."

The corners of work can be left sharp if desired, but it is much better to round or chamfer them. Round corners are easily made with strips of galvanized iron nailed to the corners of the forms. Chamfered corners are made by inserting triangular wood strips of the desired size in the corners.

FILLING THE FORMS.

The concrete should be placed as fast as mixed, and no batch that has stood over twenty minutes should be used. It should be placed in layers about 6 inches thick, and well rammed until the water flushes to the top. It should be worked up to the surface of the forms by running a shovel down the side and working the stone away from the surface. If this is well done a good finish can be secured, and hardly any surface patching will be required when the form is stripped. The rammers used should weigh about 1 to 1¼ pounds per square inch of ramming surface.

In heavy work it is a good plan to set in small boulders and stones of not over a cubic foot in size. These should be well bedded in a fresh layer of concrete, and should not be set closer to each other than 6 inches, and should be kept back at least a foot from the surface.

The concrete should be about the consistency of stiff mud. If too dry, it will not pack well and will be porous. If too wet it cannot be well rammed, the stone will sink down and the mass will not be uniform.

When it is impracticable to finish the full hight and concrete must be allowed to set to which later portions must be added, it is a good plan to rack the surface off in steps or else leave a groove into which the later work can knit. Before fresh concrete is placed on new, the surface should be thoroughly wet down and sprinkled with cement, or, better still, a layer of neat cement mortar should be applied to the wet surface.

SETTING FOUNDATION BOLTS.

When bolts are to be set in concrete the templet should be arranged to set on the form and provision made for supporting it. The concrete should be brought up close to the bottom of the bolts when the templet can be set and the bolts and washers hung from it and set. The concrete should then be brought up over the washers and the bolts should be straightened up and tested for elevation. Short pieces of pipe should be placed on the upper portions of the bolts. They can be wired to the templet and centered around the bolts by collars of old neswpapers.

MIXING BY HAND AND MACHINE.

Portable mixing machines can be used with advantage on comparatively small work. There are a number of mechanical mixers in the market, of which some are a great deal better than others. For large work it pays to arrange a plant to handle the material and concrete mechanically, but the requirements for each job differ so widely that the plant must be arranged to suit the work in hand.

Hand mixing is done on board platforms about 10 feet square. The sand is spread first and the cement on top of it, when the mixture is well shoveled over and spread. The stone, previously wet down, is dumped on top and the mass is then shoveled over again, and water is added during this shoveling, which is continued until a thorough mixture is obtained of the proper consistency.

CONCRETE WORK IN WINTER.

In winter concrete can be put in during freezing weather, provided due precautions are used. Salt should be added to the water, and it, as well as the sand and stone, should be heated. The work should be protected by covers to keep the frost out, and unless placed in very large masses exposed on top only, it is not advisable to carry on the work when the temperature goes below +16 degrees Fahr. as a minimum.

The forms should be stripped as soon as possible, if the surfaces are to be floated or rubbed down, as a much better surface can be given if the work is slightly "green." In summer the hose should be played on the work, so that it will not dry out too fast on the surface and crack.

The money we intended to save and didn't does not represent economy.

Letters to the Editor.

Snapshot of a Pioneer Locomotive.

On Market street, San Francisco, a short time ago stood this tiny locomotive, "The Oregon Pony." On a piece of canvas stretched across the side of the cab was printed: "I am on my way to the Lewis & Clarke Centennial Exposition at Portland, Ore., to see my grandchildren, the 90-ton compound moguls."

"Pony" has the distinction of being the first railroad locomotive ever run in the State of Oregon. In 1861 the Vulcan Iron Works, of San Francisco, received an order from the Oregon Steamship Navigation Company for a locomotive to be used on the Columbia River at a portage, connecting two steamboats which could not meet because of the rapid-running, rocky cascades between Bonneville and The Dalles. A seven-mile track on the Oregon side skirted the Columbia between these points. The first run was made May 10, 1862. The track was of wooden rails covered with raw-hide strips. The passengers up the Columbia River considered the service fortunate in having at its command a locomotive like this "Pony," which could transport them and their freight at the rate of ten miles per hour in little cars from the steamer plying on the river up to the rapids, to the steamer waiting above the dangerous waters.

The march of progress in those days was rapid, and after a vigorous service of about two years the "Pony" was dispensed with because the track was relaid on the Washington side of the river. The curves were made of longer sweep, the road-bed was heavier and the growing traffic was taken care of by a more modern engine. Then the California career of the locomotive began. David Hewes, a grading contractor, bought it for $1,000 and put it to work leveling the sand hills in San Francisco, the sand being dumped into the bay, as a result of which six new city blocks have been added to Market street. "Pony" has just received a new coat of paint and is being sent to Portland never to return. On her side is a brass plate bearing the following inscription. "The first Oregon locomotive, presented by David Hewes, of San Francisco, to the State of Oregon as a souvenir indicative of its early commerce as developed by the Oregon Steamship Navigation Company." Its boiler is of the return tubular type, each tube being bent U-shaped. The steam cylinders are about 6 inches diameter and 12 inches stroke. On the crankshaft is a pinion which meshes with a gear on the front axle, the track wheels are 37 inches in diameter.

SNAPSHOT OF A PIONEER LOCOMOTIVE.

T. B. Burnite.

San Francisco, Cal.

Applying Iron Filler to Castings.

A short while ago I had some experience in applying iron filler to the stand of an engraving machine which was to be highly finished. The job required that the surface, when finished, be as smooth as a slab of slate.

First I tried an ordinary putty knife in applying the filler, and then a slightly curved piece of tin, and got fairly good results; but even then, after it was hard I had to do more rubbing with sandpaper than I cared to.

The third trial, I used a small block of wood covered with burlap and canvas on top; with the filler quite thin and using this block with a circular motion I got the most even surface, but still it required too much hard rubbing.

Can any of the readers of these columns give any suggestions in regard to applying iron filler? A. J. De Lille.

A Loose Pulley Job.

At page 191 W. Osborne tells about a loose pulley. Now, as we had several loose pulleys that gave considerable trouble by running dry and cutting the shaft, until the foreman had them rebored and fitted with bearings on the same principle, it is needless to say that I found the story of much interest.

Reading about the grease recalled an incident in our shop. We had an Italian we called "Nep," who, in addition to being an all-round helper, had to oil the countershafts and loose pulleys throughout the plant once a week. "Nep" went thru the many trying places with admirable patience until it came to the plating room. In here there was a large countershaft that worried him. To reach it, he had to traverse a labyrinth of plating tanks, and then when on the ladder he had to stretch to such an angle to reach the pulley that a little slipping of the ladder would have sent him headlong into one of the tanks. He was supposed to oil this pulley twice a week, and he stuck it out for a while, until one morning he noticed the engineer filling the cups of the engine with grease. Then the idea came to him, "Why not put some in that damma pulla?" then he would not have to oil again for a "longa time." Well, he filled the cup with grease, and after a short period that pulley gave vent to its feelings in a series of shrieks. "Nep" was sent to oil it up, which he did, as he thought; but it did no good, so Eric was sent down from the machine shop to set it right. He tried to pour oil in, but soon found that it was blocked up. Whittling down a stick, he started to poke around the cup to see what was in there. After the grease was out, the pulley could be moved around only by force, the bearing being so dry; so Eric gave it one of the foreman's famous physic prescriptions, which was a thorough injection of kerosene oil, which ate away the hard stuff in a wonderful manner, and then a little lubricating oil enabled the pulley to run. The shaft and pulley had become so badly worn that the foreman decided to rebore and bush the pulley. He did this all right for the old shaft, but then he decided to replace it with a new one. Eric tried the pulley on the new shaft, 2 3-16 inches, but it refused to go on, and he found it to be .003 inch larger than the old one. "Well, wouldn't that jar you?" he said, knowing I was a witness. The pulley went too far on the shaft to warrant his reducing the size of it. Taking a piece of wood the desired length he screwed a lag screw into one end, and after sawing the head off he caught it in

a chuck. He set the tailstock center in the other end and turned the block so that when a sheet of emery cloth was wrapped around it it would just fit in the bore of the pulley. After gluing the cloth on the block, he gripped it in the upright drill chuck by the lag screw; then placing the pulley on the table and starting the drill, he kept running the block up and down in the hole, and in a very short time it was enlarged to the required size, besides having a nice smooth bearing. Eric had to stand a lot of guying from the rest of the fellows, but I thought he came out of the fix pretty well. PEDRO.

Hardening and Tempering Experience.

At page 162 H. H. B., in speaking of his experience in tempering, says he "has troubles of his own," and I would assure him that "there are others." In our shop we do general job work and repairing and also design and build special automatic machinery. We have quite a variety of tempering, and it usually falls to me to do it. The work ranges from small studs and thimbles, ¼ inch diameter by ¾ inch long, to large special taps and reamers; also forming and punching dies for power presses and other tools of various shapes and sizes. About a year ago we made a great many small cutters for bolt clippers. After assembling they were tested by cutting off ⅜ inch round cold rolled steel. The boss thought he had to temper those cutters himself, and I was delighted to get out of the job.

He took extra pains in heating, dipping and drawing them, but lost an average of three or four out of every ten right along. Then the "big boss" said I had better try it, and I thought I "saw my finish" right there. I did not see where I could improve upon the methods used by the boss, but I thought I would try something a little different and do the best I could to get the job off my hands, either by doing them up quickly or spoiling more than the boss did, so that the job would go back to him. To tell the truth, I was "sore" at having 1,400 of those pesky little cutters sprung on me at once, as so much of one thing in a bunch is very monotonous to me.

We had to heat them in a forge, and I will first tell how the boss did the job. The cutters were about 1¼x1⅛x⅜ inch. He took a piece of heavy sheet iron, about 12x12 inches and doubled it over near the middle, leaving it open about 2½ inches. Laying this on the fire, he put in eight or ten cutters, moving and turning them until they gradually came to the proper heat, and then dropped them one at a time in a pail of cold, clean water. He never allowed the water to get warm, but refilled the pail with cold water as soon as the chill was taken from it. He drew the temper on a hot iron in the usual way.

If the job had been given me in the first place, I probably would have gone at it about as he did, but seeing his hard luck I of course had to try something different, even if it didn't look any better. I first got some foundry coke and firebrick and built a deep and broad fire of broken-up coke, allowing no blacksmith coal to get into the fire, using it only for banking up. I put a piece of boiler plate over the fire and about 5 inches above it. Then putting twelve or fifteen cutters on top of the coke, I shut off the blast and let them "soak" till those in the middle of the fire would show dark red when held away from the fire. Then putting on a little blast and turning them over, I dropped them into a pail of *warm* water as soon as they showed dark red in the fire. I kept dropping them into that pail until the water was nearly boiling, then poured off part of it and refilled with cold water. For drawing I used a piece of 1x6-inch. After heating I cleaned the coals from the upper side, leaving it on the fire and banking close around the edges so as not to have the firelight to contend with while watching the colors. In this way I could keep it hot as long as I wished. By putting a long row of cutters on the iron, extending back to the cold part, I could push them on to the hot part of the iron with my hand, only using the pickups to take them off as fast as they came to the color. I drew them till the cutting edge had begun to show the first sign of blue, then dropped them in warm water. After getting started I could pick them off at the rate of about two a minute for thirty or forty at a stretch.

When the cutters were assembled and tested there were twenty-one out of the 1,400 that failed and broke in the test, most of them showing cracks. This, no doubt, was caused by heating too fast, and therefore unevenly, for I did crowd the blast on at times, getting impatient with the monotony of the job. These cutters were all made from the same brand of steel (Sanderson Bros.), and I cannot account for the difference in results between the boss' method and mine, unless it was in using warm water instead of cold for hardening and drawing. Perhaps some of your readers can throw a little light on the subject.

I once had a lot of tool-steel cam rollers to harden. After hardening one by heating and dipping in the usual way, I found that the hole was a great deal smaller at a point midway between the ends, making a "bell-mouthed" hole so small that the roller would not go on to the stud for which it was made, tho it was a loose running fit before hardening. I reasoned that as the outer surface was more exposed to the water, that part cooled and contracted while the metal near the cutter was yet too soft to resist the enormous pressure or squeezing caused by the contraction of the outer surface. As the roller became less in diameter and length, it stands to reason that the hotter and softer metal near the center would flow in the direction of least resistance, which was toward the center of the hole, thus making it "bell mouthed" at both ends. Near the forge is a water faucet and sink. I heated another roller, fitted the pick-ups around it, held it against the faucet and turned on the water directly into the hole. This faucet when partly opened would spread the stream, or "scatter," in all directions. As soon as the surface inside the hole was chilled I lowered the roller to just below the surface of the water in the sink, opening the faucet wide and moving the roller around under the stream. It came out with a straight hole and was a nice fit on the stud. Since then I have hardened a great many rollers in that way and have never had one come out "bell mouthed."

If H. H. B. had given the outside diameter of his die and the manner of dipping, it might have been possible to explain its action in hardening. From his description of the die and of the manner in which it shrank it is reasonable to assume that the thickness of stock around the hole was the same as, or less than, the depth of the die, *i. e.*, the stock around the hole was 1 inch or less in thickness; also that he dipped its upper end first. This being the case, the die, being evenly heated and equally expanded, the end first coming in contact with the water instantly contracts and draws in or "upsets" the other end, which, on being cooled, contracts to a size just as much smaller than originally as the amount it shrunk or "upset" when the die first touched the water. A die of square or rectangular shape would be likely to warp if dipped in that way (face down), and the hole would probably not be round. But he says it was a "round die," and an experienced man might easily make that error on his first one of the shape he describes and of the dimensions I assumed it to have. I would dip a die of that shape just as I would a milling cutter, *i. e.*, hook a wire thru the hole, dip it edgewise, straight down, moving slowly up and down till cold. Tongs, especially heavy ones, are apt to cause uneven cooling of the piece held by them.

In connection with the above is a nice little kink which will come handy to any machinist or blacksmith. If you have a ring or band that is just a little too large for a shrink or drive fit, heat it evenly all over and dip one end of it so that the ring or band is about half submerged. The part in the water contracts and draws in or "upsets" the opposite end. Then reheat and dip the opposite end in a like manner. (By the length of a ring or band I mean the length of its axis.) I have in this way reduced the diameters of rings of 1 inch square section 4½ inches inside diameter over 1-16 inch in three or four heats. Bands or collars that are long and comparatively thin will shrink most at the middle, leaving them "bell mouthed," but this can hardly be noticed on those of square, or nearly square, cross-section.

For some time I have been using a tempering compound, bought thru an agent and manufactured by a firm whose advertisement I have never seen in the AMERICAN MACHINIST; but I will say that it gives excellent results on nearly all kinds of work, and I feel that it would be like a step backward of ten years if I had to give it up and use water again for all kinds of work. HANDY MAN.

Boring and Turning on the Milling Machine.

I once had a headstock for a 20-inch turret lathe to machine. The boss did not approve of the expense necessary for rigging to bore it on its own bed, which was my way of doing the job. The only machine available was a No. 2 Cincinnati universal miller, which I decided would do for the job.

The head was to be bored 4½ inches at the front and 3½ inches at the back end, the back gear shaft holes 1 11-16 inches diameter, ¾ inch above the center of the spindle holes and 5⅛ inches from the spindle center.

When I planed the headstock V's I planed one side also, to have a face to work from. I clamped a long parallel strip crosswise on the miller table, square with the column, and located the head against it.

I used a boring bar of the correct size to fit the 1 11-16 inch hole in the overhanging arm. I bored the large hole to size, then removed the bar and bored the back gear hole on the same end of the head, using the graduated screws on the machine for locating. As I could not bore the small hole in the back of the head accurately—on account of the overhang—it was necessary to turn the job around, which I did by turning table and all thru 180 degrees. Then I loosened the job, pulled it back the necessary distance in order to get at the hole, and proceeded as before. This may not be an extraordinary way of doing the job, but it shows what one has to contend with, and also shows the value of a good machine.

I could dispense with the lathe almost as easily as I could do without the universal miller. When I have a chuck or face-plate job that I cannot swing in the lathe I just put it in the miller. Anyone who has tried it will agree with me when I say that the miller makes a "daisy" face-plate lathe. I have turned punches and such work in it when a lathe could not be spared. The only objection is that the hole thru the spindle is often not large enough.

I changed the method of facing die-blocks of gray iron from the shaper—where two hours were required for each casting—to the miller, where with an 8-inch face mill I turned out three per hour. The cutter had carbon steel tools in it making 25 feet per minute, the maximum economical speed.

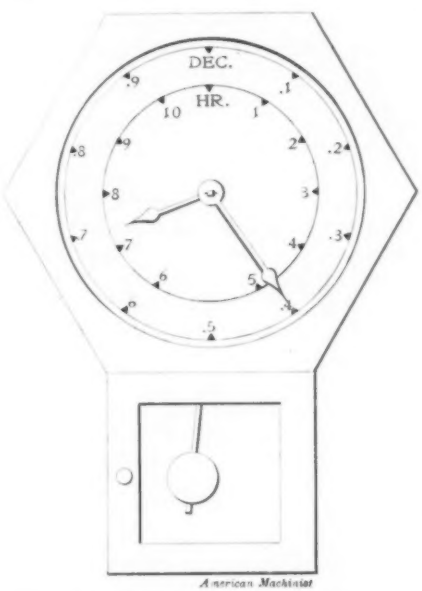
The miller is, as everyone knows, a good place to locate and bore bushing holes in drill jigs, etc. GEO. HALEY.

Decimal Shop Time Measurement.

The clock described by Mr. Hess at page 229 of the current volume is surely simpler than that described by Mr. Lewis, but the inconvenience of calculating for the intervening noon-hour might have been obviated in the following manner:

On the rim of the dial make the decimal divisions of the hour, placing the abbreviation for decimal "Dec." at the top and proceed as shown in the sketch. These will be registered by the minute hand of the clock. On an inner circle of the dial make twelve divisions. These will correspond to the regular division for the hours.

In numerating these divisions place the



ANOTHER WAY OF DIVIDING THE CLOCK FACE.

abbreviation for hours "Hr." at the top and continue around with 1, 2, 3, 4, 5, then skip one division (which is for the noon hour) and proceed with 6, 7, 8, 9, and 10. These, the working hours of the day, will be registered by the hour hand. Then to calculate the elapsed time expended on a job, subtract the time registered at starting from the time registered at the completion of the job.

Example:

Order No.....	Day	Hr.	Dec.
Finished....	7	5	3
Started.....	5	8	4
	1	6	9

Subtracting the start from the finish would leave 1 day, 6 hours and .9 hour, which in a 10-hour shop could be reduced to hours by simply writing the figures as they appear 16.9, inserting the decimal place between the 6 and the 9. 16.9 multiplied by the rate per hour would give the labor cost. W. G. S.

Vertical Drawing Boards.

There is a great diversity of opinion regarding vertical drawing boards, and I think a few more particulars of such boards may not be out of place. I have used vertical boards for a number of years and in that time have tried many varieties; therefore I can give my opinion of them from experience. As to utility, they are vastly superior to the ordinary flat boards, being able to take the largest drawing that is ever likely to be wanted and which is accessible in any place without overreaching, due to the drawing board being arranged to slide up or down. Another valuable feature is the square or straight-edge, and when purchasing a vertical board the square is one of the first things to be examined, because on it depends largely whether it will prove to be an advantage over a flat board or not. The best kind is one with a balancing weight attached to it at the back with a cord not too thin, as the thinner the cord the more it is affected by the weather.

This leads up to another point, and a very important one, too: The weather plays a very important part in the boards in question, so much so that when there is a great change in the weather there also has to be a great change in the adjustment of the various parts to correspond, and unless there is ample provision for adjustment, hours will be lost in endeavoring to fix the square and like things to prevent them from being too loose or too tight. The worst offenders in this respect are those which have for adjustment thin, endless wire; or, more correctly, what the makers call "endless" but which often contains two or three splices, making the square "jump" when they pass over the rollers, and which varies so greatly with the weather that the least change affects it; this type is also very awkward to adjust.

Some boards allow the square to be lifted only about ⅛ inch, for putting drawings under (these should be put under from the under side of the square, and not from the top), but those allowing more clearance are better; for, if working on a small drawing and the square happens to get below the bottom edge of the paper, great difficulty is experienced in getting it back again, due to the edge being crumpled—a characteristic of all drawing paper.

One more thing worth knowing about the square: When it is drawn upward it rides on its upper edge, causing whatever clearance has been allowed for putting drawings under to appear at the lower edge, and the same thing happens, *vice versa*, when the square is drawn downward, making the clearance opening at the upper edge, allowing thin celluloid set squares (which happen to be on the edge at the time) to fall thru the opening. To remedy this, set squares made specially for the board are required, with grooved edges, the T-square being grooved to correspond preventing any possibility of the foregoing occurring. In passing I might

say that the balance is so arranged that its weight presses the square against the paper, thus it is apparent that they must be more serviceable than those without balance weights.

Some squares are made with rather large heads, also bearing against the board, but their chief drawback is that they can be given only a very small clearance for drawings to insure them working properly; a better kind being those which have rollers attached running in grooves cut in the board, which prevent side play and insure easy running. As regards the boards, they are made of nearly all one design. To obtain the required equilibrium of the board a gray-iron weight is connected by wire ropes over pulleys, and pieces of wood fastened to the board slide against larger pieces, which also act as the chief part of the frame. There are also a few other types, one of which allows the board to swing over horizontally or to any angle that may be required, but the fixed boards which have an angle of 75 degrees to the floor are preferable in most cases. When the board is horizontal it might be easier to trace, because on the fixed vertical board tracing is very tiring for the hand, as it has to be on a level with the head, causing it to become bloodless and giving a sensation similar to that experienced when the hand is held up for any length of time. When drawing, that is not the case, as one cannot draw a great number of lines at once without having to refer to some drawing or other, thereby giving the hand a rest. As makers are aware of this fact, some equip their boards with a sliding table, but some have not been made strong enough, there being no support for them, and as they have to stand the weight of one writing they are not stable enough. The best thing is to have a small board near at hand on the left-hand side for tracing, writing and holding drawings.

Another great advantage vertical boards possess over flat ones is the comfortable position in which the draftsman can work. His back need never be bent and his lungs can expand freely. He can either sit or stand to suit himself. If sitting, any part of the board is easily accessible without undue over-reaching, a thing which is not possible in the larger sizes of flat boards. If a vertical board is to be worked to its full advantage, care should be taken to see that the greatest possible amount of light is obtained. For flat boards overhead light is best, but for vertical ones, light from the left-hand side is also necessary. That light plays an important part in draftsmen's work goes without saying, and no pains should be spared to obtain the greatest amount possible. Given a fair number of windows and skylights, the walls, roofs, and in fact everything possible, should be painted or washed a very light color, thus causing light to be reflected in all directions. As regards artificial light, incandescent lamps are advised: one 24 candle-power proving sufficient if so arranged that it can be moved about to any place near the board. An easy arrangement to meet this requirement can be made in wood, forming a clamp with an arm about 1 foot 6 inches long, so that it can be moved along and fastened in any position on the top of the board, giving the required horizontal movement, while the vertical movement can be obtained by letting the lamp down the required distance and then twisting the wire around the arm to keep it in its place.

There is still another reason why vertical boards are liked, and that is, the convenience of having one's instruments near at hand. On a flat board there is no place where one can deposit small instruments and drop his eye on them as soon as they are wanted again, there being no room on the board when the T-square is continually moved up or down. On vertical boards two ledges for instruments add greatly to their advantages. One is commonly connected to the square and is handy for instruments that are being used, as they can be taken wherever the square goes. This ledge should be flat and shallow, as it forms a means by which the square is moved up or down. The other one is fastened to the board at the bottom and is better for larger instruments and rulers. A drawer is also handy to keep instruments together at week ends and nights or any time when not in use. This can be fixed to the frame, but drawn out only after lifting the board a certain hight. The frames are best made of wood, gray iron being too heavy to move about and really not so suitable as a well-built wooden one. CHEDDIE.

Angleterre.

A Wail From the Strawboss.

I have long occupied an anomalous position, a position to which no true mechanic aspires, a position that until it was forced upon me by circumstances I never would have dreamed of accepting.

There are concerned in the management of our shop, in the order of their importance, Mr. Highboss, who is the owner of the controlling interest, who is business manager, shop manager, stock buyer and general factotum, and who "personally conducts" the entire establishment; Mr. Super, who is the mouthpiece of Mr. Highboss, who hires all the men without regard for their fitness, discharges them when necessary, and has nominal charge of all work going forward in the factory, all subject to the whims and caprices of the august Mr. Highboss, without whose knowledge no man is hired, no order is executed; Mr. Man, who is the intermediary between Mr. Super and me, and who delivers the orders of Mr. Super, which are the orders of Mr. Highboss, to me, when he doesn't happen to deliver them to the men, or when one or the other of the before-mentioned gentlemen does not deliver them himself; and, lastly, myself.

There are several of me, and my name is Strawboss. I am supposed to direct the efforts of the men toward the general welfare of the corporation, and such orders as I give them are carried out, unless they receive contrary instructions from Mr. Man or Mr. Super, in which case they carry out the orders of these gentlemen, unless Mr. Highboss tells me to have them do something else, when of course they will do as Mr. Highboss told me to tell them to do, unless Mr. Highboss tells them to do, etc., etc.

I am aware that this reads somewhat twisted, but it is all right and the system is a beautifully simple one when you get used to it, but it doesn't foster respect for me among my men, nor for Mr. Super or Mr. Highboss among me, nor respect for anybody in Mr. Man, nor does it pay dividends for the company. The other day one of me was working away for dear life on an order that was marked "rush," when in came Mr. Man having a telephone message from Mr. Super, who was kept at home by a slight illness, saying that he wanted the men started at once on that order that came in last night. Work was stopped on the rush order (for we had to use the same machines), tools were yanked out and others were put in their places, boxes of stock and partly finished work were shoved aside and other boxes were hauled up, and for the next two days our energies were bent upon getting out the new job in record time. When, upon the third day, Mr. Super, having recovered from his illness, appeared at the shop Mr. Man showed him what had been done and "regretted" that the job had not been completely finished up in the two days, Mr. Super calmly remarked, "It doesn't make any difference, we are not in any hurry for it, anyway."

We have a wide and a more or less valuable experience with different kinds of tool steel; for every time a fresh drummer appears at the office Mr. Highboss will buy a new kind, and as our work requires a large number of dies that are of such a nature as to allow the block to be worked over, and as this method of selection has been in vogue for twenty years, you can imagine the proposition our toolmakers are up against.

Speaking for myself, Strawboss doesn't like his job; I believe I am capable of better things, but what to do about it? There's the rub. When one has a home of one's own and is tied to a place by it and by other associations, he doesn't want to "chuck up" his job on account of such trials as this, with no assurance of not meeting with the same or worse experience at his next attempt.

One of my brothers Strawboss came to me with tears in his eyes the other day, over this very thing. His troubles were very real to him, as they are to me. He had lost control of his men, if he ever had it; he was being made a fool of by well-meaning employers, who if they could be

made to see the folly of their ways would be the best of men to work for. He was assured when he came there that he was to have "complete control" over his department, and so was I, but such control was never given us for a moment, and it is hardly reasonable to suppose that our employers did not consider us qualified for such control, or we would not be there. After we had given up good positions to take these, under what were virtually false promises, after we had "set our hands to the plow," is, or is not this sufficient excuse for turning back? To offset my trials, our trials, of this kind we are otherwise well treated, for our employers are gentlemen, and the virtual slaps in the face which we get from them are given in ignorance and not with intent, we have a comfortable and pleasant place to work in and are fairly well paid for our services. I see no way open to better our positions but the doubtful one of resigning and trying our luck elsewhere. If any of our more fortunate brethren have been thru the same experience and have recovered, I wish they would prescribe for us.

STRAWBOSS.

Locating the Decimal Point With the Slide Rule.

At page 255 there appeared an article entitled "Locating the Decimal Point With the Slide Rule." The rules given are practically the same as I have always used, except that I locate the point for a continued product or division in a simpler manner. My rules apply to the lower scales, and in division the dividend is always read from the stock.

Using the same definition for digits as is given in the above mentioned article, let us suppose it is required to find the product of

$$746 \times 74.6 \times 7.46 \times .746 \times .0746$$

This example has six positive and one negative digit, which leads me to anticipate five digits in the answer. Should the slide project to the right in performing the multiplications, I subtract one for each time this occurs. In the example given, the slide does not project to the right; hence when the figures of the result are found I put the decimal point five places from the left—that is, give the answer five digits.

In the example, required the product of $350 \times .20 \times .012$, there are three positive and one negative digit. Therefore I anticipate two digits in the answer; but the slide projecting twice to the right in performing the operation, the answer, which is .84, will have no digits—*i. e.*, I anticipated two, and subtracted two on account of the projection of the slide to the right, leaving none.

In division I proceed as follows: Required the quotient of the continued division,

$$348 \div 17.4 \div 2.5 \div .160 \div .03125.$$

From the first dividend, 348, which has three digits, I subtract the algebraic sum of the remaining digits in the example given, which will lead me to anticipate one digit in the answer. In performing the operation, however, the slide projects three times to the right, and as we add one for each time this occurs in dividing there will be four digits in the answer, which is 1600.

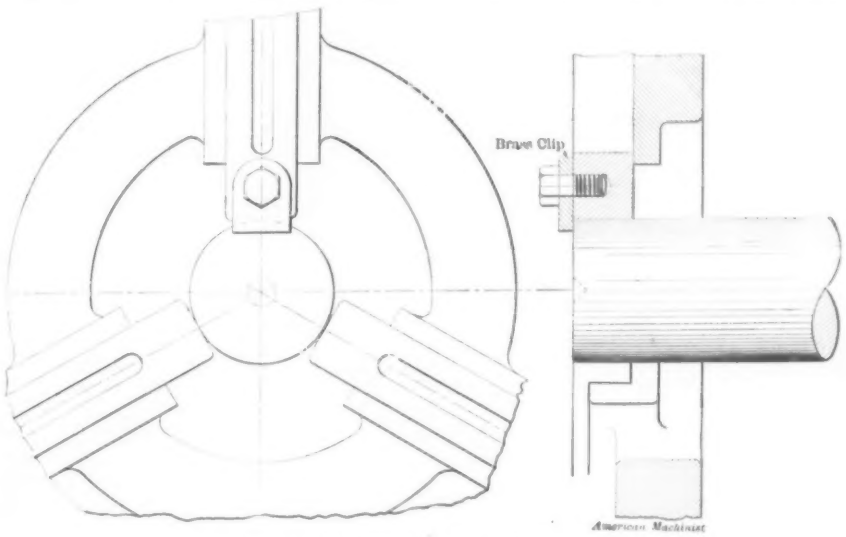
The above I am sure is much simpler than taking but two numbers at a time, locating the decimal point and then taking this result and the next number, and so on, and I hope it may be of as much use to your readers as it has been to me.

LEO HAAS.

Holding Work on the Live Center.

I have read with much interest several articles in your journal on the method of holding work up to the live center. I have seen a good many hook-bolts, clamps, collars, belt laces, etc., used for that purpose, but the enclosed sketch shows a method I have found to be the cheapest, simplest and the most effective of any. It is never lost, and when not in use the piece of brass shown is turned half way round and is out of the way. The clip here shown is a piece of sheet brass ¼ inch thick. It can also be used against a shoulder. This method I have used for the last fourteen years.

JACK.



METHOD OF HOLDING WORK ON THE LIVE CENTER.

Technical Ignorance in Strange Places.

When C. H. Norton at page 1237, Vol. 27, showed us a school drawing of a lathe footstock made by a pupil of a Boston evening school he very properly deplored the fact that there is not more contact of the schools with the practical engineering of the country. While at times it may seem a little hard on the schools, they still have no better friends than those who by kindly criticisms urge them to more closely approach the form of education most useful in practical work, for few, indeed, are the students in any of our educational institutions whose aim is not to qualify themselves for commercial and remunerative usefulness.

Drawing is a language, and errors in execution correspond to grammatical errors in word language; and unmechanical design, however good the execution may be, is the equivalent in word language of an article grammatically and rhetorically correct on a subject the author knows little about. But if there *is* an excuse for ignorance of the simpler mechanical principles in any of the schools there is more excuse for it in an ordinary evening school than in an educational institution fully equipped and directly devoted to mechanical engineering.

I have before me a technical journal ("Technical" is actually part of its name) published by a technical institute. From an article on the manufacture of a talking machine I quote the following:

"While tiny electric motors are sometimes used, a popular type of machine is operated by a spring, like the motor of an ordinary clock." "If you have a mechanical bent you will pause to watch the drills which bore holes thru the pieces of brass and steel . . . as easily as if cutting thru paper." "As the cogwheels, pinions, and governing balls are fitted to one another and attached to the spring, this part of the machine seems strong enough to pull a street-car." "Rows of men stand in front of steel slabs almost too hot for you to touch with your finger." "There are forty presses, some of which exert a weight of sixty tons."

Referring to the grooves containing the sound waves on the record proper, it is stated that "altho the lines run round and round they never cross." "They form a coil like a watch spring." "The crosshead that is fastened to the diafram and connects to the needle-arm is called a 'sliver of steel,'" etc.

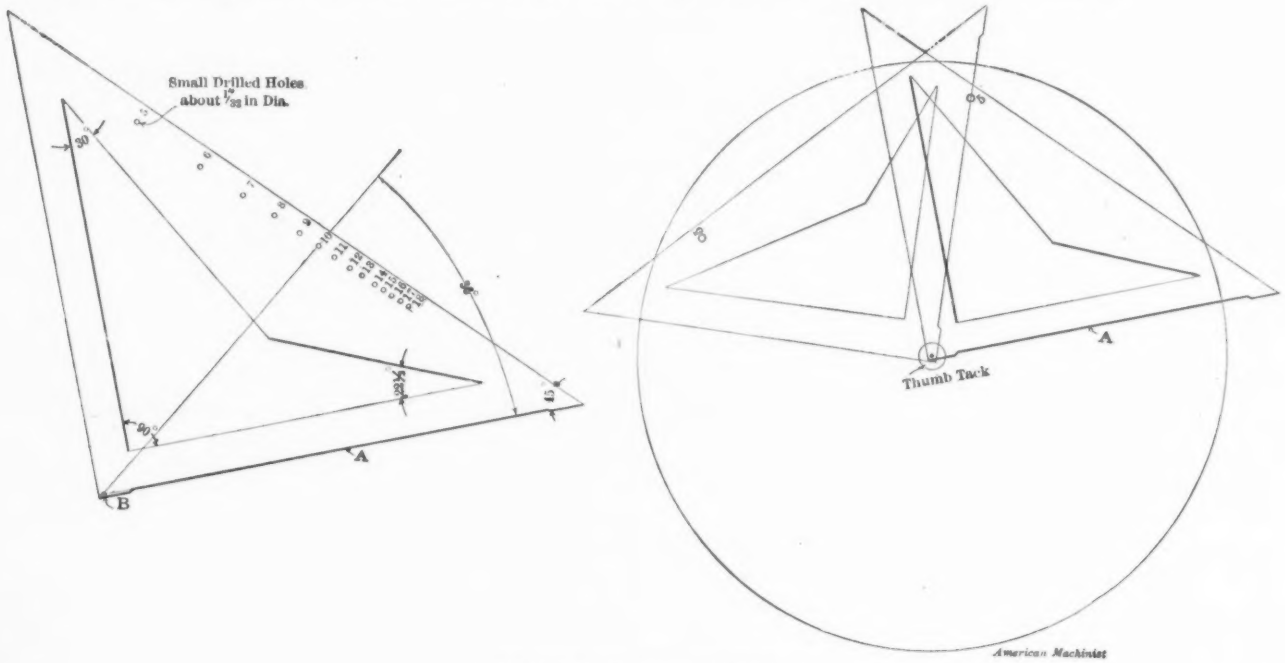
Now, in a newspaper or Sunday school paper such language might be acceptable, and indeed some of the "technical" students may relish it; but that isn't the ques-

tion. A publication back of which is an educational engineering institution of some prominence should, to my notion, not contain romantic language in articles on matter-of-fact subjects. It must present such matter to its readers in good mechanical language. If to some of the overgrown-boy students such language is too "dry" and uninteresting, they are better outside the profession, and should seek some vocation more in keeping with their non-mechanical ideas.

CORNEIL RIDDERHOF.

A Triangle for Dividing Circles.

Enclosed find a sketch of a very handy triangle for draftsmen, patternmakers and others. It is made of No. 14 gage sheet steel, or it may be of wood or other material. The hole marked *B* is for a thumb tack or a needle point. The small holes indicate the number of parts a circle may be divided into. Hole marked 5 is 72 degrees, hole marked 6 is 60 degrees from edge *A*, and so on. Fig. 2 shows the method of using the instrument for dividing a circle into five parts.



A TRIANGLE FOR DIVIDING CIRCLES.

ARTHUR W. MCALPINE.

Dimensions On Drawings.

At page 197 I note an improved method of figuring the stud shown in your previous issues, and, while considering this to be the clearest sketch shown up to the present, it is still, in my opinion, capable of improvement. The terms "run" and "drive" are satisfactory certainly, if every turner has the same ideas concerning such fits; but one man's drive fit differs from another's, and in a shop where there are a number of workmen there are likely to be many and varied results. We tried this system in the shop with which I am connected, with the improvement of using blueprints giving the sizes needed and also the limits allowable. Then "⅝" run" according to the table was .624", the limit being .0005" inch smaller.

After due consideration, helped along by numerous errors on the workmen's parts, we decided to put the actual size needed on the sketch with the limit. This saved all reference to tables, and made every drawing self-contained. It was clearly understood by the workmen that the actual size needed was .624", but if by mischance the pin was .0005" smaller, it would not be scrap. This is our present system, and we find there is no hitch whatever.

Another important point, not touched upon by any of your correspondents, is the practise of putting limits on lengths.

Suppose that the part of stud shown, 1 inch diameter and 3½ inches long, carries a pulley, the ⅞ inch diameter being held in a bracket with shoulder up to a face by means of a nut on the ¾-inch screwed part. If the pulley is 3½ inches wide, the 1 inch diameter should be longer, say 3 33-64. It should therefore be figured 3 33-64, and as coarse a plus limit as possible added—*i. e.*, 3 33-64 + 1-64 inch. This insures the part being right, and, moreover, gives the workman a chance. The same can probably be done in the other cases. Of what use is it to measure accurately when 1-16 inch, or sometimes more, plus or minus makes no difference?

I notice another point. Is it not of more importance to give the dimension for length of thread on the ¾-inch part from the shoulder rather than from the end of the pin? My experience tells me that the inside face of a nut is generally required to be some definite distance from a shoulder. This would certainly happen if all the pins were exactly 1¼ inches long, but not otherwise. All these points, if neglected, mean trouble eventually.

An intelligible limit system means less work and money saved, and can be applied to nearly everything connected with engineering.

DRAFTSMAN.

Leicester, England.

Briggs Standard Pipe Threads.

As I am interested in the accurate measurement of screw threads, my attention has been attracted to an article, "Concerning Pipe Threads," which appeared in the January number of *The Locomotive*, published at Hartford, Conn.

This article refers to the Briggs standard of pipe sizes and threads, and says, "The threads have an angle of 60 degrees, but are rounded off slightly at top and bottom, so that the depth of the thread is only four-fifths as great as it would be if the threads were sharp."

Now, we know from geometry that the vertical hight of an equilateral triangle is equal to .866 times the slant hight (or length of one side), and letting h equal the hight or depth of thread, and n equal the number of threads per inch, we have $h = \frac{4}{5} \times .866 \times \frac{1}{n}$, or $h = .6928 \times \frac{1}{n}$, and *The Locomotive* prints a table giving the diameter at bottom of thread, the figures evidently obtained by the use of the above formula.

However, we find by referring to a paper by the late Robert Briggs, C. E. (author of "Briggs Standard"), on "American Practise in Warming Buildings by Steam" the following: "The thread employed has an angle of 60 degrees; it is slightly rounded off at both the top and at the bottom, so that the hight or the depth of the thread, instead of being equal to the pitch, is only four-fifths of the pitch or

equal to $0.8 \times \frac{1}{n}$ if n be the number of threads per inch."

As this formula is very different from the one given by the author of the article in *The Locomotive*, we naturally try to analyze the statement of Mr. Briggs, when he says "the hight or depth of the thread, instead of being exactly equal to the pitch" etc., this seeming to imply that he takes the term hight to mean the slant hight, and not the vertical hight, and we find that his formula bears out this conclusion.

But we find from numerous books which give information about the parts of screw threads that the hight of a sharp V-thread equals $.866 \times \frac{1}{n}$ when n equals the number of threads per inch, and the question at once arises, does the term hight mean vertical hight when applied to ordinary V-threads, and slant hight when applied to pipe threads of "V" form?

The purpose of this article is to call out the opinion of those in a position to know, as to just what the term "Briggs standard thread" means. O. S. Bickford.

A New Way of Laying-Off Templets.

In accordance with Dixie's request, at page 230, I have not only reread his first letter but have looked still further into the matter and think, perhaps, the information I have gleaned from various sources, however slight, may be interesting to your readers.

I am pleased to note that Dixie has left off, in his last letter, all allusion to that ".0001 inch" and has now dropped his limit of inaccuracy to .001 inch or thereabouts.

Dixie says he is "not in my class—the 'A. Mateur' class." Are we to infer, then, that he is a professional photographer? My reference to my amateurism was purely in regard to photography and not by any means to mechanics. Some of the very best photographers in this country are strictly amateurs. So in "knocking" the "amateur class" he surely does *some* an injustice.

Does Dixie mean that the enlarged drawing was composed of lines .04 inch wide? He says the lines on the negative are .004 inch wide and that they were copied from a drawing ten times the size of the negative. Now, the question in my mind is this, would a line .004 inch wide be a good line to file to where great accuracy was needed? In my experience "with the aid of a powerful glass" a line .001 inch wide or even less would be about the proper thing, as it is undoubtedly easier to approximately split a narrow line than a wide one.

Dixie says "a small tin templet the total length of the finished templet was made" as a starter. We have already made an enlarged drawing; we must make the exposure in the camera, develop and wash the plate, coat the steel with a sensitive solution, print it from the negative, then the templet *must* receive some special treatment to destroy its sensitiveness to light, else it would continue printing till the whole surface would be a solid color. And yet Dixie says in Vol. 27, page 1744, "the whole cost being but a few cents." This seems to be quite a lot to accomplish for "a few cents." I wish Dixie would tell us about that sensitive solution for steel—what it is composed of, how it is applied, etc.

At page 230 Dixie says "the variation of the three final negatives was much less than .001 inch," while at page 1743, Vol. 27, he says "the error in the negative would be only .0001 inch." Now, if he means that the three negatives were exactly alike but varied from the size it was wished to obtain, that is backing down from his first statement by admitting an error of nearly ten times as much as he first spoke of, while if he means that the three final negatives varied one from another to the extent of something like .001 inch, I would refer him to my statement at page 117, Vol. 28, that "it is a little too much to expect that the image on the finished negative will be precisely the same as it was when taken from the camera."

I have talked to a good *professional* photographer, who told me that the despised rectilinear lens would, if a good one, perform the same work of this kind as an anastigmatic lens, the chief difference being, in a case of this kind, that the anastigmatic lens is capable of working faster—that is, admitting more light into the camera in a given length of time—but if the copying were done where a longer exposure could be made, without any jar or vibration of the apparatus, he didn't think the difference between two negatives made with the two different style lenses could be easily detected. He also told me I was in error when I said that "the drawing must be set into some concave surface, the radius of whose concavity must equal the distance from the lens to the drawing" provided the camera and lens had a capacity for taking a picture two or three times as large as the negative required—that crowding a lens to its full capacity was what caused distortion or lack of symmetry. *The Photo-American* gives in its July, 1904, number a chapter on lens grinding, in which I found a partial answer to Dixie's wish to know more about the limit of inaccuracy of modern lenses, from which I quote: "This extreme caution is none too great, as errors not exceeding the one five hundred thousandth part of an inch must now be dealt with." "For some purposes . . . the possible error being limited to the one million five hundred thousandth part of an inch." "It may give some idea of the care and labor necessary for the making of a lens to say that at least one year's time is required for the grinding, finishing and polishing of a 30-inch lens, while a lens 2 inches in diameter requires the unremitting labor and care of a skilled workman for a day and a half or more."

In conclusion I think some error might be eliminated from Mr. Alteneder's method if the steel templet could be coated with a solution sensitive enough to take the picture directly upon it, the only difference being that, at least in some cases, the drawing would have to be reversed—just as the negative would appear if you looked thru it from the wrong side.

A. Mateur.

Professor Sweet's Compound Rest.

After reading Prof. Sweet's article in the American Machinist, at page 321, "Things That Are Usually Wrong," I wish to say that, having used lathes fitted up with compound rests of the usual form and also one fitted up as shown in Fig. 37, I find the latter has all the desirable features mentioned by Prof. Sweet and one other not mentioned. This is, that when feeding up with the compound rest set at 30 degrees for a facing cut, the tool moves towards the headstock of the lathe just half as fast as the screw would move it if set in line with the centers, and therefore can be gaged more accurately; and if a graduated collar is put on the screw (as should be done) the movement of the tool in this direction can be gaged to a certainty. M. H. Ball.

Lead in Bronzes.

At page 331 Alfred E. Dowding states his views upon what he characterizes as "unprincipled advice." Some years ago I got the contract to build for a certain government some machines. Ninety per cent. of the parts of these machines were to be made of so-called "government" bronze—*i. e.*, 88 copper, 10 tin, 2 zink.

There were sixteen machines in all. As the patterns had been run thru in a hurry, I thought it advisable to order the castings for two machines only, at first, in case it might be necessary to alter the patterns. In due time the castings came along. The specifications called for finish all over. The material was not only tough, but very hard, and it began to look as tho the job would be a dead loss. The government inspector came along and took away some chips, which I presume were analyzed, altho I never saw him in the shop again. A few days later the brass founder who made the castings came in, and when I told him about the nature of the castings, he said he would correct it in the next lot. The first two machines being finished and the patterns found correct, the other fourteen sets were ordered. With these we had no trouble; the metal worked easily and was the same color as that in the first two. The time on each machine was about half what it was on each of the first two.

After the machines were accepted and paid for, I one day asked the foundryman how he had obtained such a change in the castings. His reply was: "By adding a little lead."

Four or five years later I was in one of the government navy yards; one of the head practical men was showing me over the machine shop. They were making a number of bronze valves, and I stepped over to look at a valve body that a man was boring in a lathe. The speed seemed to me to be rather high. Turning to the foreman, I said, "Is that government bronze?" "Yes," he replied. "Well, I never could get steel to stand up at a speed like that. Is that 88, 10 and 2?" "Yes," he replied. "Our specifications always call for 88, 10 and 2, and we get it *from outsiders;* but when we make it in here we add a little lead." DIXIE.

Automatic Turret Lathe Experiences.

In my opinion there is no class of machinery which will keep a fellow guessing more than the automatic turret lathe. Having had quite a few years' experience on repairing and rigging up such machinery, I write as one who has been there. Anybody who desires to gain knowledge in the study of cause and effect wants to get into line on repairing automatics working gray iron. On soft steel or other metals where lubricant is used there is not one-quarter of the repairs to be done as when running on gray iron; for when using a lubricant all parts are kept oiled better by its splashing over the machine. Of course when competent mechanics are hired to look after such machines they will run much better, but the general practise seems to be to put cheap help on them, which doubtless explains why they will run so badly sometimes. Most of the shops seem to have the idea that the automatic will run all right with this cheap help, but from my experience it pays to employ competent men, as more work will be gotten off, the work will be better, and the repairs less frequent. Those three items ought to be enough to convince anybody of the importance of using skilled hands.

The manufacturers might keep in mind the fact that their machines are going to break once in a while and design the parts of the machine so that they won't break, or if it is necessary to put in frail parts make them easy of access when it becomes necessary to repair them. I have in mind one make of automatic which had a small hinge spring inside the turret carriage, which spring had a habit of breaking very often. Without this spring the machine could not be run, as it controlled the movement of the part which turned the turret around. When it broke, the only way to get at it was to remove the turret carriage from the ways—a job for two men on account of the weight—and then take out the slide and remove the spring. To add to the difficulty, when replacing the turret carriage on the machine, it had to go back in precisely the same position in which we took it off or it would not run. We didn't catch on to this for a while, but after we had occasion to make the repairs three or four times we tumbled to the above fact and the next time we noted down in just what position everything was when we took the carriage off and were careful to put it back in the same position, and had no trouble after that putting it together. After putting in three or four springs we made a longer stud and put more coils in the spring, and have had no more trouble along that line. The turret of this machine was mounted on a taper stud, but instead of the small end of the taper being at the top it was at the bottom, and to get the turret off it was necessary to take the stud out, and to get the stud out of course the carriage had to be removed from the ways.

Another thing I have noticed in connection with automatics is that the builders do not usually put in enough oil holes, trusting to luck to get some of the bearings oiled. The last automatic we received was equipped with a geared countershaft for speed changing. Now this is all right; it is a good scheme, but evidently they didn't give it a fair trial before they sent it out. My idea is when anything new is devised give it a good running trial before sending it out, so if it develops any defects they can be remedied on the spot. After filling all of the oil holes in the countershaft—and it took two cans of oil altogether—we started it up. The counter was driven from the main shaft by one belt with tight and loose pulleys, and, not content with using the old-style shipper rod, they put on a rope with a 2-inch leverage to throw the belt over. Anyone can imagine how easily a 4-inch double belt would pull over. There are two driving pulleys to the machine: one is fast on a sleeve which has a bearing on the steel shaft, the other is fast on another sleeve which has a bearing on the first sleeve. After the machine had run an hour it developed a hot box in the sleeve that ran on the inner sleeve. We oiled it, let it cool off and oiled it again and started up once more. While watching it running we saw dust rising from the shaft, and on investigation saw that about everything was of gray iron. The sleeve bearing on the shaft was cool, but the outer sleeve of iron bearing on the inner iron sleeve was all worn out, there being a good sixty-fourth play between the sleeves after a few hours' run. It must have been carelessness sending out anything like that, for surely nobody would expect gray iron to run on gray iron at 400 revolutions per minute with the strain of a 4-inch double belt. I think this shows the importance of having new schemes thoroughly tested before sending out of the shop.

It perhaps wouldn't be good business policy but it would be a good scheme in other ways for the builders of these complicated machines to issue a catalog or treatise with drawings of the machines assembled and the different parts and the best way of getting things apart in case of breakage. Repairs then could be finished in much shorter time. Now, a catalog of this description would be a great help to the man in charge of the repairing. From his standpoint at least this question of making repairs easier is certainly a live one, and should be looked into by manufacturers. PAUL WESLEY.

An Adjustable Cam—A Curious Failure in a Machine.

I came across a wrinkle in cam construction recently that is new to us up here in the wilderness, tho it may prove to be ancient history to the dwellers of the settlements. At any rate it is a great improvement over the usual construction. I refer to cams which drive the roller in a line parallel to the cam shaft and give a positive movement in both directions. Such cams are used on bobbin lathes and other light automatic machinery.

In this case the cams were about 8 inches diameter, of gray iron, and the slot was for a 1-inch roller; the work was light, being the drilling of wooden pipe stems and similar turned wooden goods. As the machine was practically the first of its kind made here, it seemed advisable to provide as well as might be for changes in the cam movement as well as to allow taking up wear of the cam and roller. To this end the cam was cast in two sections, one having a long hub fitting the driving shaft and turned outside to receive the shorter and larger hub of the other section. The outer hub was keyed to the inner one and this was keyed to the shaft. For this light work set-screws took care of the end thrust, but a threaded collar on the inner hub would be safer for heavy work. By sliding one hub on the other it is an easy matter to keep the slot adjusted to the diameter of the roller, and it is also possible to slightly vary the path of the slot by grinding or filing and then bringing the two sections together endwise.

In the operation of a former machine for doing this work, a curious failure was found, one which few would have thought of providing against; in fact, I doubt if those who have not run against a similar snag would have believed failure possible from such a cause in a machine whose working parts were so light and moving at a very moderate speed compared to many automatic machines. The new machine was built largely to overcome this one unsuspected defect.

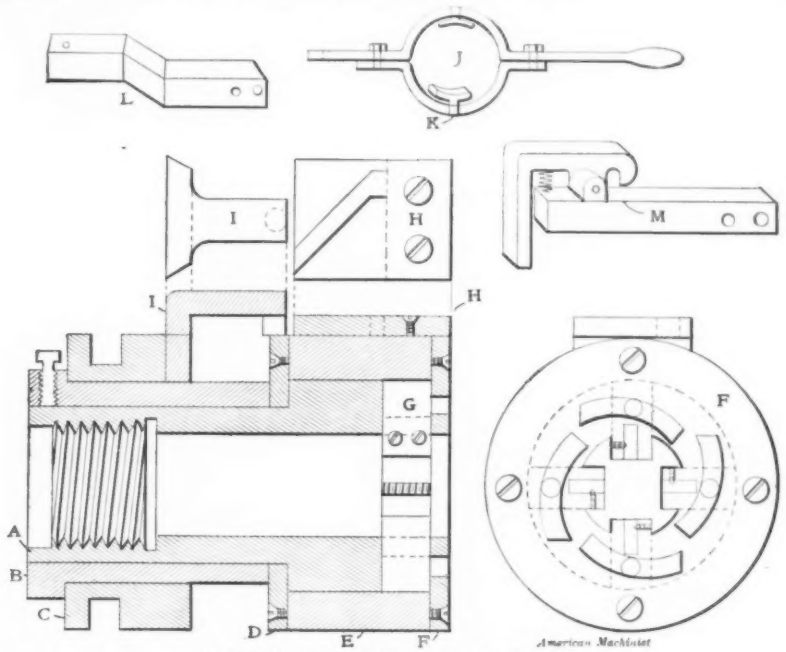
In the earlier model the pipe stems were held in a chuck while the drill was forced into them by a combined rotary and lengthwise motion, as in any drill press. To avoid clogging with borings it was necessary to withdraw the drill one or more times, according to the depth of the hole, and the shock of these rapid reversals and of coming to rest caused a crystallization of the steel, from which the drills often broke off square at the chuck after a few days' use and before the point was much worn.

The new model moves the work to and from the rotating drill, and it is this movement that the adjustable cams were designed for. We do not look for crystallization of the wooden pipe stems, but it would not surprise us much more than the failure of the drills did.

E. R. PLAISTED.

An Opening and Closing Rotating Die.

Having a large amount of work such as small rods, etc., to thread I designed a die like the sketch. It is used on what we call a friction tapping machine, but it can be used on any lathe. *A* is the body of the die, which I made from cold rolled stock. This is screwed on the spindle, and grooves are milled in the front for dieholders *G*. *B* is a ring made from the same stock, with a set-screw, as shown, for the adjustment of the dies. *C* is a ring, gray iron, for closing or opening the



OPENING AND CLOSING THREADING DIE.

dies, and is splined on ring *B*, allowing it to slide forward. *I* is dovetailed to it, and is made of tool steel hardened, a small pin, ¼ inch in diameter, being milled from the solid piece to follow the cam groove in *H*, which also is tool steel hardened and screwed to ring *E*, which is gray iron. Cam *F*, of tool steel hardened, also is screwed to ring *E*, having spiral slots milled thru it, as shown. Ring *D* is fastened by screws to *E*, holding *E* in position. The die-holders *G* are made of tool steel, not hardened, with ⅛-inch slots milled in to receive the dies or chasers, which are made from ⅛x½-inch annealed tool steel, fastened firmly in the holders by two 8-32 headless screws tapered to a point, which draw the dies back tight in the holders, the dies having countersunk holes to receive same. *J* is a lever with two small pieces *K*, which fit in the circular groove in ring *C*, and is pivoted on piece *L* fastened to the headstock of the machine. I have a spring on the front of the lever, near the handle, which is fastened to the headstock with a small eyebolt tapped into the same, and on the back a rod with a catch, as at *M*, which holds the die closed when *C* is pulled forward, and is released by a 5-16 inch round rod (adjustable for different lengths of thread), attached to the tailstock spindle and following its movement. H. H. B.

Making Machine Dies for Screw Cutting.

Noticing the articles at pages 163 and 182, on dies, hobs and chasers, I have a little practical experience to relate. We have just put in our works two screw cutting machines, and the principal work is 1-inch Whitworth pipe thread to be cut on drawn steel tubing. The trouble first experienced was the tearing off of the threads. I came to the conclusion that the cause of this was that there was not enough rake on the cutting edges. I took the chasers out of the holders and ground a rake of about 15 degrees. This proved to be a little better, but the die still tore the threads away. I found that the chasers were cut taper, which is the usual practise for short threads; but we wanted to cut both short ends 1 inch long and running ends of 2⅛ inches with the same chasers, and I found this could not be done with the dies sent with the machines. The cutting was done along the entire length of the chasers, 1⅜ inches, and this caused the crowding and tearing off of the threads.

Another little trouble I experienced, which had never come to my notice before: the chasers on a running thread were not cutting the correct pitch, 11 to the inch, but were cutting a pitch somewhat finer. This was on account of the chasers being cut taper. I explained this to our works manager, and he gave me permission to make a set of chasers. The first thing to make was a hob, or master tap. This I had made the depth of the thread smaller in diameter than the Whitworth standard size for pipes, and it was cut with spiral flutes. It had a plain stem 3 inches long and 1 inch diameter, to hold it in the machine jaws. The threaded part was 3 inches long, the largest diameter was at the front end, and it was .005 inch smaller at the back. This was to give a slight clearance to the chasers to avoid the crowding and to get the cutting done on the leading threads. This hob was hardened and tempered to a light straw. I next had a set of chasers that were sent with the machines annealed and set up in the machine holders and started hobbing them up to a full thread, holding the hob in the machine jaws and keeping a slight pressure on them as they traveled along. This accomplished, the chasers were taken out of the machine, the burrs were taken off, they were hardened and tempered to a red, ground off on the leading threads, given a rake on the cutting edges, and all was ready for a test. The result proved to be equal to the best thread a machine would cut, not a scratch nor a tear on the work produced. I may state that they are now doing satisfactory work, after five weeks' running, with occasional grinding of the cutting faces. E. J. T.

A Gear Cutter Kink.

While using an automatic gear cutter on a variety of sizes of gears with teeth ranging from 49 to 312, and also for slotting, the divisions running as fine as 950, the work came so it was necessary to make many changes of the indexing gears, and as the table was made out, it was sometimes necessary to change all the gears in the train to get the required division, taking much time besides increasing the liability of mistakes.

While on this work I discovered that a simple principle for the gearing existed, that could be easily remembered and applied (to our work at least), which rendered me independent of the gear table; it proved so handy in my case that I give it for the benefit of the craft.

The index wheel had 180 teeth; the worm was single thread, and the driving shaft made one complete turn for each division; in this construction it is obvious that if equal gears are placed on both worm and driving shafts, and connected direct, the division indexed will be 180, and contrariwise if it were possible (which it is not) to place a gear of 180 teeth on the driving shaft and of 1 tooth on the worm, then the division produced would be 1. Hence it follows that if the driving gear and the compound intermediates together produce the equivalent of a gear of 180 teeth, then any gear on the worm will produce the same division that it contains teeth. This condition is easily produced by providing a compound

intermediate pair having the same ratio as the driving gear and index wheel; thus to cut 67, put 67 on the worm shaft, 80 and 40 for intermediates, 90 on the driving shaft.

For the large gears, which were always in even inches on pitch diameter, and cut 12 pitch, I simply measured the pitch diameter of the blank; if 22 inches, put a 44-tooth gear on the worm shaft (double the diameter of blank in inches) and a 30-tooth on the driving shaft, connected direct, thus giving 30 to 180 = 1 to 6 and 22 to 44 = 1 to 2, which together equal the pitch, or 12 *P*.

Had the pitch to be cut been 10, then a 36 on driving shaft would have been correct; or for 8 pitch use 45.

It is interesting to note that, with single intermediates, if 90 is used on the driving shaft, then twice the number is cut that the worm shaft gear contains teeth: if 60, then three times the number; 45, four times; 36, five times; 30, six times, and with reducing compound intermediates of 2 to 1 ratio then the above become four, six, eight, ten, twelve times the number of teeth in the worm shaft gear.

CHARLES S. BEACH.

Gray Iron and Graphite.

In a paper before the Staffordshire Iron and Steel Institute, Mr. O. F. Hudson said that, of the three great classes of iron, cast iron is the most impure. It never contains less than 2 per cent. of impurity and may contain 10 per cent. In determining the grade and quality of cast iron the ratio of graphite to combined carbon is the most important factor. Metal containing a constant total amount of carbon may, by varying this ratio, be made to assume all varieties from white to very gray iron. Prominence has recently been given to the view that cast iron may be considered as steel, with, in the case of gray or mottled iron, flakes of graphite scattered thru the mass. Very mild steel consists of nearly pure iron, and its microstructure shows practically only one constituent, ferrite. Gray iron, it may be said, is steel made weak and brittle by the presence of flakes of graphite, and, as steel with the lowest carbon content is the softest steel, so gray cast iron with the lowest percentage of combined carbon is the softest and most easily worked iron.

In pouring chrome steel (one per cent. chromium) into molds, there frequently is formed a slight flash, or oxide, which would seriously injure the strength of the casting. To "cure" this evil the workmen throw into the crucible a bit of metallic aluminum as large as a walnut. As the aluminum burns instantly with a blinding flash, it appears that its service consists in reducing some iron oxide that has been formed. Therefore, this is essentially only another instance of the use of what, in different form, is called thermit.—*American Manufacturer.*

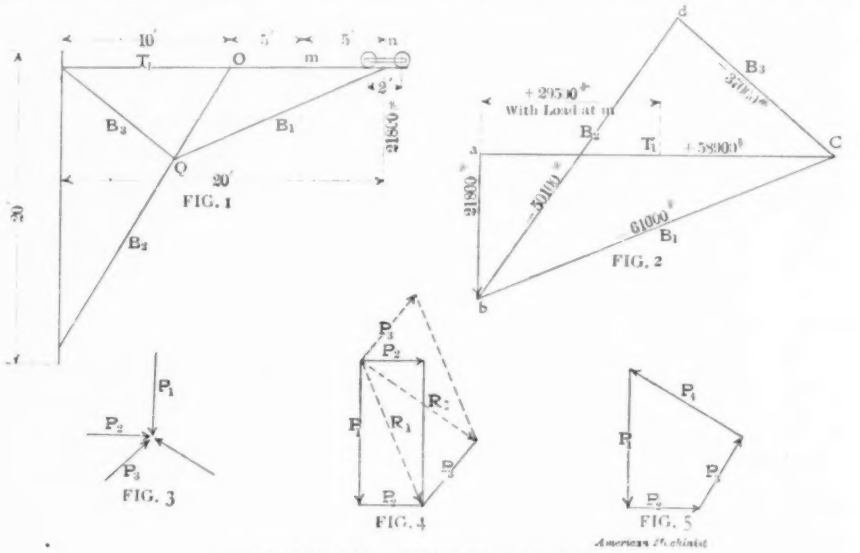
The Graphical Analysis of a Simple Jib Crane.

BY A. L. WESTCOTT.

Fig. 1 shows an outline of an ordinary under-braced jib crane, the principal dimensions being given. The trolley is shown in position of maximum radius, the position in which the stresses in the underbracing will be most severe. The following data are specified:

	Pounds.
Capacity of crane.....	20,000
Weight of trolley.....	1,000
Weight of chain block.....	300
One-fourth the weight of jib..	500
Total load on crane.....	21,800

The determination of the stresses in the members of the crane by means of a simple application of graphical statics, is shown in Fig. 2. The lines of the diagram are lettered to correspond to the letters used to designate the crane members which they represent.



GRAPHIC STATICS APPLIED TO A JIB CRANE.

The construction of the stress diagram is based upon the principle that when a number of forces are acting upon a point, if the directions of all the forces, and the amounts of all but two, are known, the two unknown forces may be determined. Thus, at the outer end of the jib, at *n*, we have three forces acting, consisting of the load, a known force; and the two unknown forces acting along the brace B_1 and the jib T_1. The triangle *a b c*, Fig. 2, represents, to scale, these three forces, and is constructed as follows: First, a vertical line *a b* is drawn, of a length to represent, to scale, the known vertical force of 21,800 pounds, which constitutes the load on the crane. The lines *a c* and *b c* are then drawn parallel, respectively, to the jib and brace T_1 and B_1. It only remains to scale these lines and record the results on the diagram, as indicated, compressive stresses being indicated by a minus sign, and tension by a plus sign.

The question as to whether a given stress is tension or compression may usually be determined by an inspection of the figure, or from the following considerations:

In Fig. 3 we have a number of forces, P_1, P_2, P_3, P_4, acting upon a point, their directions being indicated by the arrow heads. Fig. 4 shows the corresponding force diagram. First taking the pair of forces P_1, P_2, we construct the parallelogram of forces as shown, getting their resultant R_1, whose direction is as indicated by the arrow. Then with R_1 and the third force P_3 a second parallelogram is drawn, whose resultant R_2 must be equal and parallel to the fourth force P_4, but opposite to it in direction, thus holding it in equilibrium. Now, if all the lines shown broken in Fig. 4 are erased, we will have remaining, Fig. 5, a polygon of forces, in which each line represents, in both amount and direction, the force, Fig. 3, with which it is parallel. It will be noticed, also, that in passing along the perimeter of the polygon, the arrow heads which represent the directions of the forces point constantly the same way, the arrow head of one line being always in contact with the opposite end of the next line. Thus, if the start is made in the direction of a known force, as P_1, we will always, in passing along the perimeter of the polygon, be going in the direction of the successive forces of the system.

Applying this principle to our diagram, Fig. 2, we first place an arrow at the lower end of line *a b*, as this force is known to be downward. Then passing along the line *b c* from left to right, it appears that the stress in the brace *B* acts from left to right, and is therefore a compressive stress. A similar consideration with regard to the jib T_1 determines its stress to be tension.

Passing next to the point *Q*, where B_1, B_2 and B_3 meet, we can at once construct another triangle *b d c*, Fig. 2, *b d* being drawn parallel to B_2, and *d c* parallel to B_3. To determine the character of these stresses, note that the direction of the

known stress B_1 is toward the point Q under consideration, or from right to left, B_1 having already been determined as a compressive stress. It follows, by applying the method explained in connection with the triangle $a\,b\,c$, that stresses B_2 and B_3 are also compressive. The portion $O\,Q$ of brace B_2 is without stress, except the small amount due to the weight of the middle part of the jib which it carries.

The sizes of braces B_1, B_2 and B_3 may now be figured, using Gordon's formula for long columns, and a Carnegie or other pocket-book containing tables of the properties of standard rolled structural shapes.

For the jib the most severe stresses occur when the trolley and load are at a point m midway between the two braces. The maximum fiber stress in tension for this position may be computed by adding together the stress due to flexure and that due to the uniformly distributed tensile stress from the diagram, Fig. 2. This may be expressed by the formula:

$$S = \frac{P_1}{A} + \frac{P}{4} \times \frac{l}{R} \times F.$$

S = maximum fiber stress tension,

P^1 = horizontal tensile stress uniformly distributed;

P = vertical load;

A = sectional area of jib members;

l = length between supports of braces B_1 and B_2 in inches;

R = section modulus of jib members;

F = factor for two rolling loads,

$$= 1 - \frac{2}{10} + \frac{2^2}{10^2} = .81$$

Assume, for trial, a pair of 12″x20.5 lb. channels. In this case for the load P we have 21,800 pounds.

P^1, from Fig. 2 = 29,500 pounds.

l = 120 inches.

R, for two 12″x20.5 lb. channels, = 42.8.

A, for two channels comprising the jib = 12.06 square inches.

$$\frac{P^1}{A} = \frac{29{,}500}{12.06} = 2{,}400 \text{ pounds per sq. inch.}$$

$$\frac{P}{A} \times \frac{l}{R} \times F = \frac{21{,}800}{4} \times \frac{120}{42.8} \times .81 = 12{,}400 \text{ pounds per square inch.}$$

S = 14,800 pounds per square inch.

The maximum compressive stress in the member is found by subtracting the uniformly distributed tensile stress from the maximum fiber stress in compression; thus, designating by S^1 the maximum compressive stress, we have:

$S^1 = 12{,}400 - 2{,}400 = 10{,}000$ lbs. per sq. in.

Many a factory owner owes a large share of his success to having surrounded himself with good, competent, faithful workmen, and many a workman owes his start in business to the kindness of some employer; so, while we may not be able to say the score is even, we can at least see that each can help the other.—*Woodworker.*

Vibration in Machinery.

BY W. BURNS.

High-speed engines and machines have some distinctive troubles of their own which are not at all common to their more leisurely brethren, one of these being that of vibration. The following experiences may be found interesting as showing the effects of an unbalanced mass when rotating at a high rate of speed, and the means employed to overcome these undesirable effects.

TROUBLE WITH A DISK GRINDER.

The first case was that of a disk grinder. This machine was of a well-known make, having an 18-inch steel disk affixed to each end of the shaft which was supported by a journal at each end, the driving pulley being in the center. Rings of emery cloth formed the grinding medium, these being affixed to the steel disks by means of glue, a coarse grade of emery being used on one disk and a finer grade on the other. The machine was rigid and of heavy design and ran satisfactorily for a considerable time; but, as the emery sheets were being rapidly used up—due partly to the carelessness of the apprentices in grinding small articles and using undue pressure on the wheel, which soon tore up the surface of the cloth—the management decided to replace the sheet on which the rough grinding was done by an emery wheel ¾ inch thick and of the same diameter as the steel disk.

The ring was affixed to the steel disk in the same manner as the emery sheets, and gave excellent results for some time; but the machine soon commenced to vibrate very badly, so much so in fact that it was extremely difficult to grind a piece of work on the machine, due to its tendency to travel all over the table. As this state of affairs could not be allowed to continue, an investigation of the machine was made. On examining the journals it was found that the one next the ring was slightly worn and that the shaft had about ⅛ inch end play. Nothing else being found to account for the vibration, the journal was adjusted and a ring placed on the spindle to take up the end play. The machine was then started, but it was found that tho the vibration was reduced it was still there, and that if the machine was allowed to run it would soon be as bad as before.

After some consideration it was decided to try whether the spindle and disks were balanced; this was done by taking the spindle out of its journals and placing it on two straight-edges which were set parallel to each other and perfectly level. By this arrangement the spindle was allowed to turn with a minimum of friction, thus allowing any want of balance to be observed. It was at once seen that there was a heavy side on one of the wheels, so the spindle was replaced in its journals and the steel disks were tried to see if they were running true; these were found to be all right, but it was noticed that the emery ring was slightly out of truth on the face and edge.

The machine was started up at a slightly less speed than when working and the emery ring trued up by means of an emery wheel dresser, the lower speed being used to get rid of the vibration. When the wheel had been trued and the machine was run at full speed, it was found that the vibration had disappeared and that the machine ran as smoothly as before; the heavy side on the emery ring, due to uneven wear, had been the cause of all the trouble.

VIBRATION IN A WOOD-WORKING MACHINE.

The second case was that of a dovetailing machine. This machine was among a group of other wood-working machines, including some planers. The spindle in this case was vertical, there being a journal at both top and bottom, and in addition an end journal to support the weight of the shaft and to take up any end play, as end play in a machine of this description would cause the dovetails to be cut to uneven depths, thus spoiling the appearance of the work. There was no heavy mass attached to this shaft, as in the case of the disk grinder, there being simply a plain shaft with two collars at the top journal and the dovetailing cutters having a tapered shank and fitting into the top of the spindle which was driven by a light pulley about 4 inches in diameter.

This machine would run for a long time without any vibration, then without any apparent reason it would commence to vibrate so badly that it was impossible to do any work on it, which proceeding on its part greatly puzzled the man in charge. His method of getting over the trouble was to stop the machine and wait some time, then start up again, when it was often found that the vibration had disappeared. As the trouble was getting worse it was decided to call in the engineer and get things made right. On examining the machine it was found that the journals had worn very loose and that the shaft was also pretty badly worn; the journals were adjusted and the machine speeded up and ran all right. There was a slight vibration, but it was practically nothing, and would not affect the working of the machine.

Suspecting, however, that the slackness of the journals was not altogether the cause of the vibration, the engineer asked to have some of the machines around started up, still keeping the dovetailing machine running. All the machines were fixed on a wooden floor supported by joists underneath and raised some distance from the ground. No sooner were some of the machines set in motion than the dovetailing machine seemed to get into tune with the vibration set up in the floor and to vibrate very badly. This satisfied the engineer that it was the shaft that was at fault and, seeing that it was somewhat worn, it was decided to make a new

one in preference to using any means to put the machine out of tune with the rest or deaden the vibration. When the new shaft was put in place and connected up there was no further trouble.

A SUGAR-MILL EXPERIENCE.

The third case was that of a sugar mill direct connected to an electric motor and running at 2,500 revolutions per minute. This mill had previously been driven from an overhead shaft by means of a broad belt and had given no trouble. As the mill was being shifted in position and there was a long length of shafting with no other machines driven from it, it was decided to install an electric motor, and to preserve the alinement of the shafts the motor and the mill were fixed on a gray-iron bedplate; the journals of the mill at the same time being rebabbitted, as they were slightly worn.

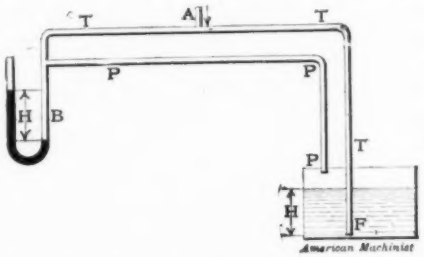
Before leaving the shop a trial run was made, when the mill ran very smoothly, the bedplate simply sitting on the concrete floor. The mill was then installed on the floor on the first flat; the under side of this floor carrying the shafting for driving a large number of machines on the ground floor. When the mill was started up the vibration produced in the floor was very great, producing a curious numbed feeling when standing at the machine for some time, and the various tools lying on the floor showing a tendency to travel about, which greatly amused those who were not responsible for the machine.

As this state of affairs could not be tolerated, an investigation was made. The motor was disconnected from the mill and run by itself, which showed that it was the mill that was at fault, as there was no vibration. The mill spindle was then taken out and tried for balance, and found to have a heavy side on it; as it had not been giving any trouble previously to being shifted, this had not been examined when at the works. The spindle was also found to be slightly worn. This was trued up and the mill balanced. To prevent any trouble which might occur thru the shafts not being exactly in line, the coupling, which was of the sleeve type, was bored slightly larger than the shaft for the mill, the motor end being a tight fit; to prevent any twisting action two keys were fitted one on each side of the shaft. This allowed the motor shaft and the mill shaft some slight end play and did not make so rigid a connection.

To avoid any trouble which might be caused when working by some of the sugar adhering to one side of the mill and putting it out of balance and so causing vibration, about 1 inch thickness of felt was placed underneath the bedplate of the machine and the machine was bolted down to the joists, felt also being placed between the bottom bearers and the joists, thus practically insulating the machine from the floor. There was no felt underneath the mill when driven by belt, the belt appearing to steady the machine and absorb any vibration. When starting up the machine after alterations there was practically no vibration, the machine running very satisfactorily.

A New Gage.

Our contemporary *The Mechanical Engineer*, of Manchester, publishes an illustration of a new gage which seems likely to prove of very great usefulness. This gage is for the purpose of measuring the depth of a liquid in a tank, and the tank may be in any location at any distance from the gage, or at any elevation above or below the gage. The principle of this gage, which was designed by a man named Murphy, is shown by the diagram herewith, in which F is a tank containing a liquid standing at the hight H. Extending nearly to the bottom of this tank is the pipe T, the other end of which is connected to a U-gage, as shown. For simplicity's sake, and for illustrating the principle of operation, let us suppose that in the U-gage is the same liquid as is in the tank. Under these conditions, if at the point A in the pipe T air be forced in, by



ILLUSTRATING PRINCIPLE OF A NEW GAGE.

a bellows or other means, it will displace the liquid in that part of the tube which extends into the liquid in the tank, and the air will eventually escape at the bottom of this pipe and rise to the surface. Supposing the tank to be open to the atmosphere, then when this escape of air takes place, the hight of the similar liquid in the U-tube will be as shown at H, or, in other words, the difference in hight between the two levels in the tube will equal the hight of the liquid in the tank. In case the tank is closed, the pipe P is introduced. If an initial pressure is in the tank, this pipe P will cause a rise of the level of the liquid in the U-tube, which rise will represent the pressure on the surface of the liquid in the tank. If, then, air be blown into the tube T at A, the liquid in the U-gage will rise a farther distance, which distance will equal the depth of the liquid in the tank, when the air escapes at the bottom as before.

It is of course obvious that mercury or any liquid heavier or lighter than the liquid in the tank may be used, allowance being made in the scale of graduations. This principle has been applied to a gage made by the Schaeffer & Budenberg Company, and it may be, we understand, so arranged that a superintendent or proprietor may sit in his office with one of these gages before him, and by successively connecting this gage with any number of tanks about the works by means of stopcocks, may thus in a few moments ascertain the existing depth of liquid in any tank to which the system is connected.

Trade With the Congo Free State.

The Congo Free State trade is steadily increasing, and the regulations governing imports and the assessment of duties thereon are well formulated and rigidly enforced. Except in special cases provided for, the import duty is 10 per cent. ad valorem. The metrical system of weights and measures has been officially adopted. All importations must be accompanied by a detailed declaration, which must clearly show the country of origin of the goods; the number, kind, marks and numbers of the packages; the kind of goods contained in each, or, if shipped in bulk, the weight or measure of the goods, their value and the locality or factory to which they are destined.

The value to be declared for goods dutiable ad valorem is that at the place of origin or manufacture, to which must be added the charges for freight, insurance and commission up to date of their arrival at the port of admission in the Free State open to importations. This declared value does not include that of the package in which the goods are included, as they are, as a general rule, supposed to have no market value independently of the goods they contain. If at any time it is decided that such packages are of value, a declaration of the same may be insisted upon, so that duty may be levied and collected.

Collectors of customs may demand invoices for the purpose of establishing the duty, but these need not be accepted as setting forth the true value. If goods are undervalued, they may be retained for the use of the State, the importers to receive the value and 10 per cent. additional. An attempt to smuggle constitutes an offence punishable by penal servitude for from fifteen days to six months, and a penalty of fifteen times the duties due on such goods. When the quantities of goods exceed the declared quantity by 5 per cent. a penalty is declared of fifteen times the duty on the undeclared quantity and fifteen times the amount of which the State would have been defrauded if the error had not been discovered.

Ships, boats, steam engines, mechanical apparatus used in industry, agricultural implements, locomotives, wagons and materials for railways in operation are to be dutiable at 3 per cent. ad valorem. Locomotives, railway wagons and materials may be imported free during the period employed in the construction of the lines and until they are open for traffic.

A. F. T.

Radial Stresses Due to Centrifugal Force in Revolving Bodies.

BY A. M. LEVIN.

It was to be expected that the article at page 1389, Vol. 27, relating to stresses due to the centrifugal force in revolving bodies should meet some criticism by gentlemen who have deliberated upon Mr. Stodola's thorough and general treatment of the subject.

Regarding the main point at issue, it is evident that, when applying mathematics for the determination of the stresses in a material body subjected to external forces it is necessary to make some assumption as to the molecular nature of the substance in question. Freely, it may be assumed, as is often done in cases where the forces are applied in the way the centrifugal forces are, that the body is a rigid system, or it may be assumed that it is composed of a perfectly elastic substance. The latter assumption leads to somewhat greater stresses in the material and may therefore be recommended; but, altho the *nearly* perfect elasticity of materials, after some initial stress, is generally acceded to, the theory that the deformation is proportional to the stress at all points between initially no stress and the maximum allowable is not universally accepted. This question may materially modify the deductions as to the strength of a body, derived on the assumption of perfect elasticity, when the general deformation of the body is not such as to call for a considerable difference in stresses at the various points of the section.

Robert Cramer has pointed out, at page 1572, Vol. 27, that Grübler's deductions, assuming a perfectly elastic substance, give for a solid cylindrical disk a numerical coefficient 4.5, instead of 4, as given in formula (6), page 1390, and the former coefficient agrees, with some minor eliminations, with Mr. Stodola's formulas for the same form. C. V. Kerr quotes the coefficient 4 in connection with the bursting of emery wheels, page 972, Vol. 24, Transactions A. S. M. E. In the case of a solid disk of straight tapering section, the coefficient derived from Mr. Stodola's formulas, on the same bases, will be 2.3, against 2 in formula (13), page 1390, AMERICAN MACHINIST.

This discrepancy between the formulas deduced on the two extreme assumptions of a rigid and a perfectly elastic substance, corresponding to a difference of 6 to 9 per cent. periferal velocity for equal strain or 12½ to 15 per cent. difference in the strain at equal velocity, would not seem to be of great practical consequence; remembering that all outside, possibly disturbing, influences have been disregarded.

More serious than in the case of a full disk is the difference between the coefficient 9 for a perfectly elastic cylindrical disk when it has a small hole drilled in the center, and the coefficient 4 for one assumed rigid. Practically considered, it does not seem natural to suppose that a small hole drilled in the center of the disk should weaken it to less than half its original strength, but that such is the case the theory unmistakably points out—assuming the body to be perfectly elastic.

With the assumption of perfect elasticity and taking the lateral contraction of the material in consideration, the coefficients R and T, page 1391, will, on an average for a material such as steel, bronze or gray iron, be as follows:

	Solid disk. 0	Small hole. 0+	¼	⅜	½	⅝	¾	⅞	1
Body of even thickness R,	4.87	9.75	9.78	9.88	10	10.3	10.6	11	11.5	12
Tapering section T,	2.3	2.3	4	6.3	7 9	9	9.9	10.6	11.4	12

Carrying out further Mr. Cramer's very pertinent comparisons, we have the equation for a disk of constant radial and tangential strains, formula 41, page 139, Stodola,

$$y = y_a e^{-\frac{\mu w^2 x^2}{2\sigma}}$$

which, after introducing the symbols previously employed and after reduction, becomes

$$S(\log. b - \log. y) = 6 \frac{\gamma}{g} w^2 x^2.$$

Assuming a form of logarithmic section as specified at page 1390, we have:

$$\log. b - \log. y = \frac{x}{a},$$

thus $$S = 6 \frac{a}{x} \frac{\gamma}{g} w^2 x^2,$$

and making $x = \frac{D}{2}$ we get

$$S = 12 \frac{a}{D} \frac{\gamma}{g} V^2.$$

This formula gives:

for a ratio $\frac{D}{a} = 8$ $\qquad S = 1.5 \frac{\gamma}{g} V^2$

and for a ratio $\frac{D}{a} = 9$ $\qquad S = 1.33 \frac{\gamma}{g} V^2$,

which is practically, if not exactly, the same strains as given at page 1391.

When the disk diameter D becomes larger than, say, $10a$ the result from the two methods of deriving the formulas differ some, but at such ratios the disk would in any case be unsuitable for practical use.

In every practical case there will arise complications on account that possible initial strains or vibrations in the material must be considered, and there may be a difference in temperature of the center and the perifery of the disk, in which case, it can readily be proved, a matter of a very limited number of degrees will materially affect the question of its strength on the assumption of perfect elasticity. The actually allowable velocity of a revolving body will on this account finally be decided partly by a correct choice of the factor of safety, which should be made with a view to all the facts, among which may be counted these: that in a rimless solid disk of any of the sections considered previously the elasticity of the material has practically no great influence on its strength, but that the estimated maximum stress per square inch of a disk, the center of which is bored out, will be materially higher when figured as for a perfectly elastic body, than what equation (6) would show, using the numerical coefficient 4. Nor should the circumstance be disregarded that it is likely, in regard to this subject as in the majority of others of the same character, that a superior judgment in connection with a simple formula would be trusted rather than *vice versa*, and that therefore the whole subject would not seem necessarily to belong exclusively to the four hundred.

Smoke vs. Fire.

An old-time Scotch foreman, by the name of Aundy Kloch, had in his employ one of his own kin, a Scotch molder by the name of Dunes. Dunes was very fond of his pipe, and was continually smoking, to which Aundy, the boss, very much objected; especially during working hours.

Dunes had some trouble one day getting a draw on his pipe (which was of the corn-cob variety), and was continually ramming a vent wire down the stem and putting in a new charge of tobacco, this process being kept up until Mr. Dunes got behind in his day's work; for at the end of the day he was just one flask shy.

Aundy, the boss, could stand it no longer. So he says: "Mr. Dunes, Oi would loike to shpake a word till yez."

"Oi Aundy, make it a dozen while you're at it."

"Ye air very fond of shmoking, Mr. Dunes?"

"Yis, Aundy."

"And yez shmoked all morning, Mr. Dunes?"

"Yis, Aundy."

"And yez shmoked all noon hour, Mr. Dunes?"

"Yis, Aundy."

"And yez shmoked all afternoon, Mr. Dunes?"

"Yis, Aundy."

"And yez shmoked when the blast was on, Mr. Dunes?"

"Yis, Aundy."

"And yer short one flask in your day's work, Mr. Dunes?"

"Yis, Aundy."

"Well, where there is so durn much smoke as all that, Mr. Dunes, there must be some fire, so Oi'll jist foire yez" (and he did).—*Iron Molders' Journal.*

An English process of treating timber with sugar, and called from the inventor "powelizing," is said to make mine timbers stronger, to aid them in recovering from overstraining, and to preserve them from dry rot.

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Briggs Standard Pipe Threads.

Probably there is no one thing in connection with machine-shop matters over which there has been more misunderstanding first and last than there has been regarding the Briggs standard for pipe and pipe threads. Since the adoption of this standard, nearly twenty years ago, mechanics have asked at frequent intervals whether lathe tools for cutting such threads should be set square with the axis or with the conical surface of the work; whether, to insure a proper fit, pipe ends should be to the standard gage and the fittings small, or the latter standard and the pipe end large; and how much difference should there be between the diameters of the threaded portions, measured at the end, or how many threads allowed for screwing up tight with the pipe tongs. And now comes a correspondent with an interesting letter which is published in another column and in which some pertinent points are raised in connection with the depth or hight of the thread.

As will be seen from this communication, the author of an article on pipe threads recently published in the *Locomotive*, of Hartford, states that "The threads have an angle of 60 degrees, but are rounded off slightly at top and bottom, so that the depth of the thread is only four-fifths as great as it would be if the threads were sharp"; and a table accompanying the article and giving the diameter at the bottom of the thread has evidently been worked out in accordance with the above statement, that is with the depth of thread computed at 0.8 × the actual depth of a sharp 60-degree thread of the same pitch, instead of 0.8 × the pitch or *slant* hight, which are of course alike in 60-degree threads with sharp top and bottom. The basis of this method of getting the thread depth is without doubt the following so often quoted from the paper referred to by Mr. Bickford, on "American Practise in Warming Buildings by Steam": "The thread employed has an angle of 60 degrees; it is slightly rounded off both at the top and at the bottom, so that the hight or depth of the thread, instead of being exactly equal to the pitch, is only four-fifths of the pitch, or equal to $0.8 \times \frac{1}{n}$ if n be the number of threads per inch."

Taking that part of the statement which says "the hight or depth of the thread instead of being exactly equal to the pitch is only four-fifths of the pitch," it is impossible to infer that by "hight or depth" is meant anything but *slant* hight, as the vertical hight is most certainly not "exactly equal to the pitch," and the formula $.8 \times \frac{1}{n}$ must then give us the slanting and not the true hight. But the thread depths obtained by this reasonong we believe are considerably shallower than pipe threads are usually made. For to the best of our knowledge such threads actually have a *vertical* hight equal to four-fifths of the pitch; that is, the lead is multiplied by .8 instead of by $.866 \times .8$, which is quite a different matter. Such tables as we have seen in the past containing pipe-thread data have all given the true (vertical) depth of thread as $.8 \times$ the pitch; and the figures given in Kent's Pocket Book for the diameters at top and bottom of thread show a similar thread depth.

The latter authority, however, makes the statement under the table that the 60-degree thread is "slightly rounded off at top and bottom, so that, instead of its depth being equal to its pitch, *as is the case with a full V-thread*, it is 4/5 the pitch.". As the depth of a full V-thread is actually $.866 \times$ the pitch—unless we consider the depth as measured down the side of the angle—this statement doesn't simplify to any great extent the thread depth question raised by our correspondent. Well may he wish "to call out the opinion of those in a position to know, as to just what the term 'Briggs standard thread' means." Many there be who do not know and many perhaps who think they know but do not.

For a Patent Appeal Court.

A new court of patent appeals is badly needed in this country if the complications arising from the present system are as serious as represented. Under the existing plan, which terminates all or most of the cases in the Circuit Courts of Appeal, there may, it appears, be as many different interpretations of a patent right as there are circuits. Thus a car brake, for instance, may alternate between legality and illegality as it travels about the country. A patent might lawfully have one owner in Pennsylvania and a hostile one in Ohio, just as a man might have one lawful wife in New York and another in South Dakota.

The inherent desirability of standardizing patent jurisprudence admits of no question, especially since it is all a matter of Federal control and no further encroachment upon the dwindling independence of the States would be involved here, as in securing legal uniformity upon questions like that of divorce, where a centralization of control, tho perhaps for the best, all things considered, cannot be brought about without the establishment of a regrettable precedent. This patent business is, moreover, peculiar in deriving its inharmonious features, not from discrepancies in the laws applying to different parts of the country, but from contradictory interpretations of the same laws. There is really no room for denying that a more systematic plan would in itself be advantageous. Two bills for the creation of a patent appeal court have been offered in Congress. One of these would draw its material for the court from the existing Federal bench, while the other would look anywhere for its judges, and the difference of opinion resulting from these two points of view bids fair to prevent an agreement which might enable the passage of either.

In considering the organization and powers of such a tribunal it would be well to have a clear understanding of the status of our existing Federal courts under the Constitution and otherwise. Laymen who attempt to write upon the subject are apt to betray some misconceptions in this respect.

The Constitution vests the judicial power of the United States "in one supreme court, and in such inferior courts as the Congress may, from time to time, ordain and establish," and no curtailment of the sovereign prerogatives of the former could of course be made without an amendment to the Constitution. Subject to this limitation the inferior courts are created and regulated by statute. Congress can make and unmake them. The Circuit Courts of Appeals were thus created a few years ago to remove some of the burdens of the Supreme Court, whose calendar had fallen something like four years behind. It was intended to make their jurisdiction final upon certain sorts of cases, such as patent ones; but in order to conform to the Constitution the Supreme Court retains the power of removing cases to itself at its discretion. Thus it is not strictly true that the Circuit Courts of Appeals have for any kind of actions ultimate jurisdiction, altho for some practical purposes they may be regarded as courts of last resort.

If, now, it were intended to set up a new court with sovereign powers in the adjudication of patent rights, a constitutional amendment would be required for the purpose and we should have, in effect, two Supreme Courts, which would make an almost unthinkable breach in our historic form of government. As a parallel case we might imagine the election of a special Congress to deal with the subject of freight rebates or railroad passes; or of an independent chief executive to control our relations with South America and Santo Domingo. Between two Supreme Courts, even were their respective fields of jurisdiction defined with all possible care, conflicts would be likely to arise, and our judicial system would be stultified. We do not think anyone intelligently advocates resort to such an expedient as that.

A satisfactory patent appeal court can, no doubt, be created by statute, subordinate to the Supreme Court, as are the Circuit Courts of Appeal to-day. Some difficulties may, of course, be encountered. If it is to be a centralized tribunal, intended to take over the cases now reviewed by the Circuit Courts of Appeal the question of geographical convenience may assume importance. Further, it is hard to see how one court could begin to consider the great volume of patent cases now emanating from the lower tribunals. If the new bench is to sit in judgment over the Circuit Appeal Courts it will tend to add another to the successive stages which must be surmounted in seeking justice and which are easily made a means of oppression by powerful and unscrupulous interests. Perhaps the best solution of the difficulty would be to give the new court jurisdiction only of cases where an actual conflict has arisen between the opinions of two or more Circuits of Appeal. It is true that this might inspire unsuccessful suitors to bring actions in different circuits and thus provoke a disagreement for appeal. But antidotes to this tendency might perhaps be found in a reciprocal application thru the various circuits of the *stare decisis* (stand by the decision) rule, if not in an enactment precluding the litigation of points decided in any circuit, which latter method would tend to eliminate the function of the patent appeal court entirely.

The suggestion that the proposed bench be recruited in part from men of engineering training is a worthy one. How the pure disciple of Blackstone ever makes head or tail to some of the miracles of mechanism which come before him for explanation is a marvel to the bystander. We venture to submit that nine out of ten intelligent mechanics would recoil in terror if asked to read the report of an average patent case.

A man living in Jersey City, who is proclaimed as a mechanical engineer but whose name does not appear upon any of the professional lists at hand, declares that the astronomers are all wrong about the distance of the earth from the sun, and that instead of being 93,000,000 miles it is 1,460,000 miles. He arrives at this conclusion by the curious process of taking the circumference of the earth and assuming that the earth moves in its orbit around the sun, each day, a distance precisely equal to the earth's circumference; in other words, that it rolls upon the path of the orbit without slipping; so that a point upon the earth's equator generates a cycloid proper instead of the curtate cycloid, as the astronomers think it does. This man had better stick to mechanical engineering. Aside from a dozen other proofs that he is entirely wrong, there is no apparent stoppage of the sun at midday, as there would be if he were right.

Many people have been wondering how to reconcile August Belmont's presidency of the Civic Federation and his statement of principles at the time of his election with the trouble he has been having with his employees of the Interborough railroads in New York. Some light is shed upon the matter in a recent number of the *National Civic Federation Review*, according to which Mr. Belmont had been assured the last thing before leaving on his regular annual trip to the South that there would certainly be no serious trouble; that if differences arose they would be settled by arbitration in accordance with an existing agreement, and Mr. Belmont had told Mr. Stone, Chief of the Brotherhood of Locomotive Engineers, that he (Mr. Stone) might name all six of the arbitrators instead of half of them, as the agreement specified. It is also stated that the local leaders of the strike were warned by the national officers of the Brotherhood before it took place that it was unauthorized, would be in violation of a solemn written agreement and would not be supported. Thus, according to the leaders of the national organization, Mr. Belmont's skirts are clear and he has done nothing contrary to the principles of the Civic Federation.

Socialists have long maintained that the large and larger corporations and monopolies were socialistic in principle and have rejoiced to see them wax powerful, believing that eventually they would all be swallowed up in one grand monopoly owned by the people; and competition would be killed. And now we have Governor Hoch of Kansas taking a similar view, with, however, an important difference. He boldly proclaims the Standard Oil Company to be socialistic, but as stoutly maintains that the act of Kansas in going into the oil-refining business is not socialistic at all. Just how he makes this out is a curiosity. The materials and the men to build and equip and operate oil refineries are to be had by anyone who has the capital, or who by ownership of wells can command the necessary credit. For the State, therefore, to go into the refining business is as much socialistic as to go into the business of building machine tools. Pipe lines and railroads, however, are monopolies. If the State of Kansas can see to it that every citizen has precisely the same rights in and on these the backbone of the monopoly will be broken. It is only another case of utterly failing to discriminate between monopolies and essentially competitive enterprises.

Monthly Meeting of the A. S. M. E.

The next monthly meeting of the American Society of Mechanical Engineers in New York will be held at the Society House, 12 West Thirty-first street, Tuesday evening, March 28, when Prof. Howard T. Barnes, of McGill University, will read a paper entitled "Formation of Anchor Ice and Precise Temperature Measurements." During a series of years the author has been conducting a remarkable group of investigations upon the formation of anchor ice and that special form of ice known as "frazil" in the Northern water power plants. These are not only of great practical interest, but are also of general scientific significance, since they show that the phenomena of ice formation occur within a very narrow range of temperature. The type of electrical platinum resistance thermometer developed in these investigations promises to become applicable thru a wide range, and particularly where the point of observation must be at a distance from the point at which the temperature is to be ascertained. Types of these thermometers will be exhibited.

New Tools and Machine Shop Appliances.

THE INTER-POLE VARIABLE SPEED MOTOR.

The accompanying illustrations show a new line of electric motors which is the most recent output of the Electro Dynamic Company, of Bayonne, N. J., together with the performance thereof.

The distinctive feature of these motors is the inter-poles which are clearly shown in Figs. 1 and 2, their office being to offset the effect of armature reaction when the motor is running at high speed under a

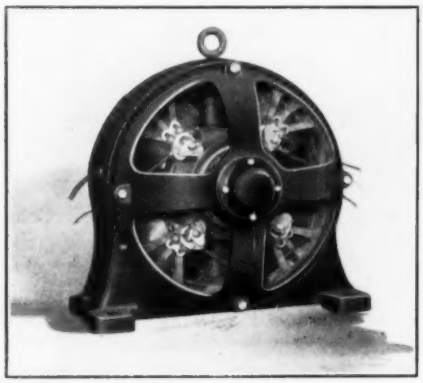


FIG. 1. MOTOR COMPLETE.

weakened field, for the speed control of the motor is by field resistance.

The effect of the armature reaction is to weaken the field at the commutating edge and, with the entire field weakened for high speeds, the effect may even reverse the lines of force at this point and thus lead to sparking especially at heavy loads. It is this action, in fact, which limits the speed variation which is practicable with

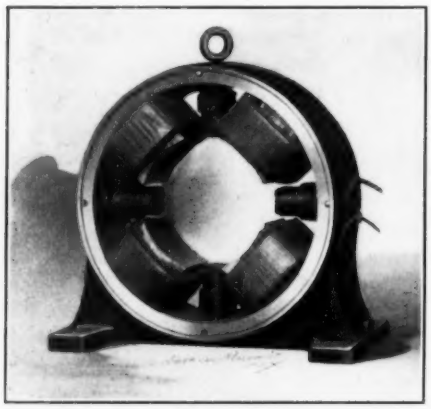


FIG. 2. THE FIELD.

field control and the office of the inter-poles is to offset it by maintaining a proper strength and direction of the lines of force at the commutating edge.

These poles are wound in series with the armature and hence their action increases as there is need for it under the increase of armature current and reaction with heavy loads. For the same reason the sparking due to heavy overloads is provided for and it becomes possible to operate the motor under 100 per cent. overload at any speed without sparking. The action holds also when the direction of motion is reversed. The inter-poles being in series with the armature the currents in the two reverse together and hence the

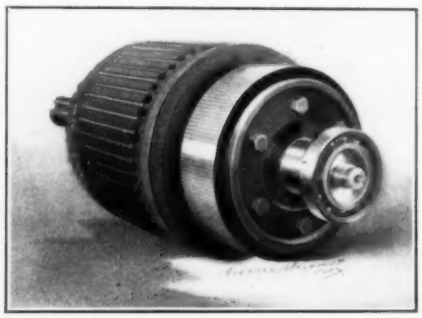


FIG. 3. ARMATURE COMMUTATOR AND BALL BEARING.

action is equally perfect in both directions of motion and of course the chief aim of all variable speed motor design—high speed range with sparkless commutation—is the leading thing secured. Satisfactory

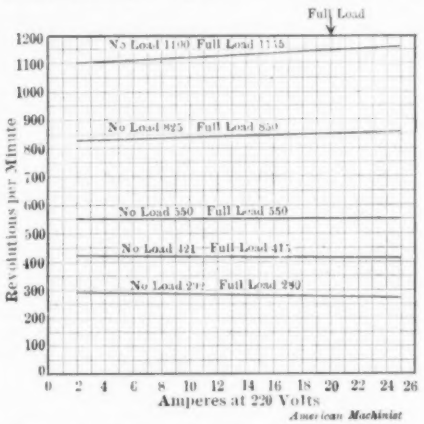

Full Load
No Load 1100 Full Load 1135
No Load 825 Full Load 850
No Load 550 Full Load 550
No Load 421 Full Load 415
No Load 272 Full Load 280
Revolutions per Minute
Amperes at 220 Volts
American Machinist

FIG. 4. REGULATION CURVE OF 5 HORSE-POWER 4 TO 1 VARIABLE SPEED MOTOR.

commutation is obtained at any reasonable speed range, but of course this motor is not exempt from the universal law that increase of speed ratio increases the size and cost of a motor for a given horse-power.

The effect of armature reaction being compensated, it becomes feasible to use a depth of slot and an amount of wire on the armature that would otherwise be inadmissible and hence to increase the power obtainable from an armature of given diameter, and the same compensation makes it feasible to use with entire success air gaps as small as 1-16 inch and thus reduce the strength of the field necessary to force the lines of force across the air gap—all of which leads to a reduction in the size of the motor for a given power.

The effect of the inter-poles upon speed is the same as that of a differential field winding, but this effect varies with the

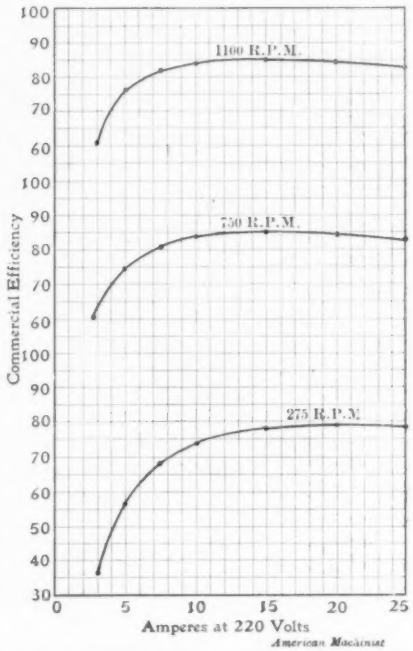


FIG. 5. EFFICIENCY CURVES OF 5 HORSE-POWER MOTOR AT VARIOUS SPEEDS.

speed. At high speed when the main field is weakest the effect of the inter-pole field is at its maximum and leads to a slight increase of speed with the load; at medium speed when the main field is stronger the differential effect is less pronounced, while at the minimum speed when the main field is very strong the differential effect is negligible. These effects are shown on Fig. 4.

The motors are fitted with Hess-Bright ball bearings which, together with the small air gap, have an important effect upon the efficiency, especially at high speed and light load. Fig. 5 gives efficiency curves at three speeds thru a wide range of loads, and Fig. 6 gives the efficiency at a constant load and at various speeds.

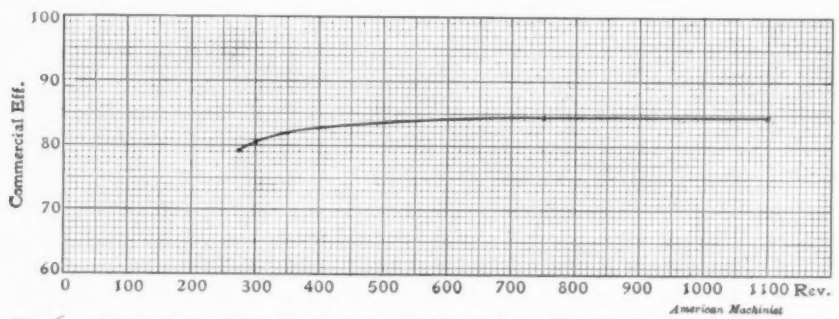
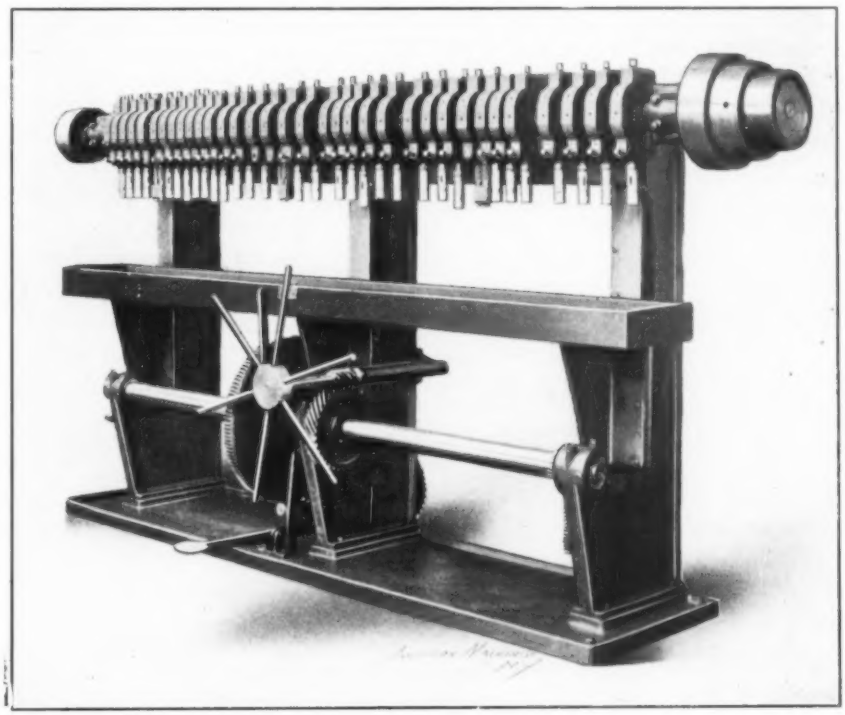


FIG. 6. EFFICIENCY CURVE ON LOAD OF 20 AMPERES AT 220 VOLTS AT DIFFERENT SPEEDS.

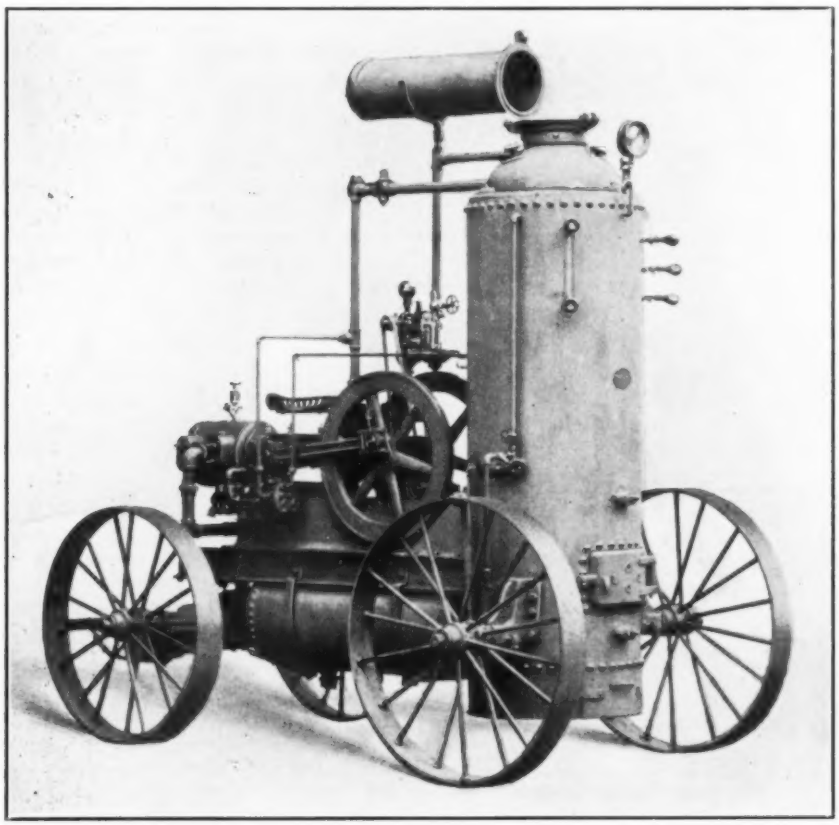
The provision of ball bearings dispenses with oiling devices and makes it feasible to operate the motor any side up and without change, while the Hess-Bright bearing, being adapted to act as a step bearing, the motor may if desired be operated with the shaft in a vertical position.

A PORTABLE STEAM-DRIVEN AIR COMPRESSOR.

The rapid and extensive development of the application of compressed air to industrial uses has created an extensive field of employment for the portable air compressor, and the half-tone shows an apparatus designed to meet this demand. As will be seen, it is complete and entirely self-contained, combining boiler, steam cylinder, air cylinder, circulating pump, air receiver, etc., all mounted on the one truck. The compressor is of the familiar Clayton type, the steam cylinder and air cylinder being in line, the air cylinder here projecting at the left while the steam cylinder, concealed in the half-tone by the flywheel, is between the crosshead and the crankshaft, rods on each side connecting the crank pins in the flywheels with the projecting ends of the crosshead. The eccentrics operating the steam valves are on the crankshaft inside the bearings. The circulating pump will be noticed below the air cylinder and the air receiver suspended horizontally from the frame. The boiler is of course provided with all necessary



GANG DRILL.



PORTABLE STEAM-DRIVEN AIR COMPRESSOR.

appurtenances. The circulating pump is for the water in the air cylinder jacket, water being usually held in a barrel or other receptacle alongside. The compressor will supply air at 100 pounds, gage, for hammers, riveters or other tools, or at lower pressures for other service. The air pressure is maintained by a pressure governor, while the compressor is prevented from running away, in case of the breaking of an air connection or from any other cause, by a fly-ball speed governor, the two governors operating upon a common throttle valve. The steam is exhausted into the stack, which folds down, as seen, for transport. The compressor is built by the Clayton Air Compressor Works, 114-118 Liberty street, New York.

GANG DRILL.

In this machine each spindle is driven by a spiral gear which is supported in a groove planed out to fit it in the rail. The spindles are of crucible steel, run in bronze bushings, are vertically adjustable, and are driven by bronze gears. As shown, there are three special heads having two spindles each, which will drill holes only ¾ inch apart. The regular spindles adjust to within 1½ inches of each other. The capacity of this particular machine with its thirty-seven spindles is up to 3-16 inch drills, altho it can be furnished for any size of drills required up to 1½ inches. The table is provided with two T-slots and wide water pan, and is moved up and down by three steel racks which mesh into steel pinions cut in the feed shaft which is very heavy. It is counterbalanced, provided with automatic stop and quick return, and is very easily handled by the pilot wheel in front. The feed is by worm and spiral gears, and three changes are provided. The machine, with a 9-foot rail and for drilling holes up to 3-16 inch, weighs 4,200 pounds. It is built by the Moline Tool Company, Moline, Ill.

FILE CLEANER.

Horatio S. Miller, 2 Sargent street, Worcester, Mass., has made an improvement upon the well-known and familiar file cleaner, which is composed primarily of a piece of carding fastened to a thin

strip of wood. Mr. Miller's improved cleaner is of the same general type, but the fastening is much superior and the entire article is gotten up in a much more neat and workmanlike manner than has been customary. He calls it the National file cleaner, because, as he says, one of the earliest orders he received for them was a large one from the Government for cleaners to be used in its various machine shops. The leather and wire are made for the purpose and the leather is fastened to the back by wire stitching which passes thru the leather and wood backing.

A DOUBLE SWIVEL VISE.

The illustrations show a machinist's or toolmaker's vise which may be swiveled in any direction horizontally or vertically. By referring to the line cut, Fig. 1, it will be seen that there is a friction block bored to the same diameter as the base, and projecting slightly thru the body. When a piece of work is clamped between the jaws, the stationary jaw forces the friction block against the base, thereby locking the

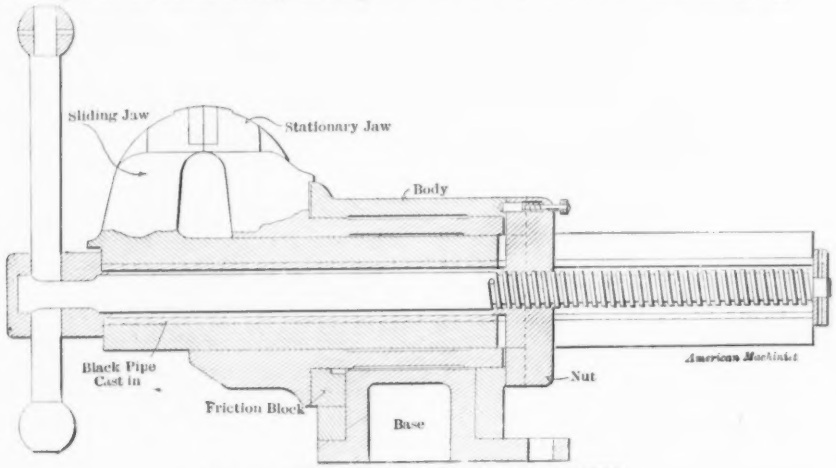


FIG. 1. SECTION THRU DOUBLE SWIVEL VISE.

horizontal swivel. The back jaw does not reach quite thru the body, therefore the body is clamped between the nut at one end and the stationary jaw at the other, thus locking the vertical swivel. The jaws are kept in line by the nut, which is the same diameter as the body. The cross-bar which carries the nut passes centrally thru a slot in the sliding jaw. As this slot does not run the whole length of the jaw, it does not show in front of the stationary jaw when the vise is full open. Figs. 2 and 3 show the vise in different positions. Both the horizontal and vertical swivels are provided with locking pins, as shown at Fig. 3, but they are merely to maintain a fixed position, the friction clamps being powerful enough to resist any ordinary force. This vise is made by the Reed Tool Company, Erie, Pa.

New Publications.

We have received from the Norman W. Henley Publishing Company "A Boiler-Room Chart" designed by Geo. L. Fowler, price 25 cents. The chart is 14x28 inches and is a fine example of isometric perspective. It shows a boiler-room of generous size with a water-tube boiler installation, showing every detail of the boiler and all the modern appliances and appurtenances, including superheater and automatic stoker. The parts are shown in section wherever necessary and are all designated by numerals. The names of the parts are given in columns at each end of the chart, the last number being 235.

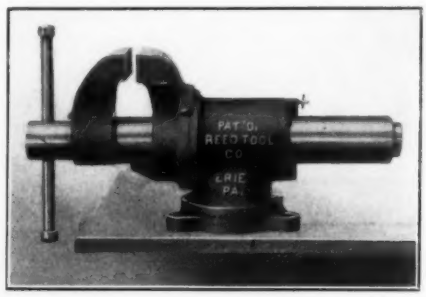


FIG. 2. DOUBLE SWIVEL VISE.

"Annuaire pour l'an 1905," published by the Bureau des Longitudes. With scientific notes. Pp. 788, 3⅞x6 inches. Paris: Gauthier-Villars, Quai des Grands-Augustins, 55. Price 1½ francs.

This fat little almanac for 1905, as usual, contains a great mass of information on

FIG. 3. DOUBLE SWIVEL VISE, SHOWING LOCKING PINS.

astronomical, geographical, statistical and other subjects, including the metric system.

"The National Electrical Catechism." The National Electric Company, Milwaukee, Wis.

This catechism is a serial leaflet of which Vol. 1, No. 1, is before us. It is intended to put in simple form the leading facts and principles of electricity, including items from experience that are not given in other publications. It will be sent free to all inquirers.

Personal.

Chas. D. Knight, formerly with the General Electric Company at Schenectady, N. Y., has been appointed chief engineer of the American Electric & Controller Company, 12 Dey street, New York city.

E. B. Boye, who has for five years past been connected with the Chicago house of Manning, Maxwell & Moore, has been appointed manager of the Cleveland office of that company in the Williamson Block.

George W. Adams, formerly foreman of the General Railway Signal Company's plant at Buffalo, and recently made general foreman of the company's shops at Rochester, has now been appointed master mechanic of the company.

A. S. Fairbanks and H. A. Moody, both members of the American Society of Mechanical Engineers, and the latter lately engineer for the Union Bag & Paper Company, have formed a partnership under the title of Fairbanks & Moody, with offices at 150 Nassau street, New York, where they will make a specialty of industrial engineering, the designing and construction of paper and pulp mills and hydraulic development.

Gardiner C. Sims, of the former Armington-Sims Company, has become general manager of the Marine Engine & Machine Company, at Harrison, N. J., a part of Newark. In this shop will be built the Secor oil engine, which has been described in our columns, and also the Armington & Sims steam engines with which Mr. Sims' name is identified. Mr. Sims will also be recalled as the man who was commissioned to fit up the floating machine shop "Vulcan," which did such good service during the Spanish War.

Obituary.

Joseph M. Titsworth, vice-president and treasurer of the Potter Printing Press Company, Plainfield, N. J., and a son-in-law of the founder of the company, was asphyxiated by the fumes of a gas stove at his home in Plainfield, March 14. Mr. Titsworth, who was fifty-nine years old, retired early in the evening, and accidentally turned on the gas after extinguishing the flame, and was found dead in the morning.

William John Kennedy died at Schuylerville, N. Y., March 14, seventy-five years old. Mr. Kennedy was well known to Eastern manufacturers of textile machinery as master mechanic of the Saratoga-Victory Manufacturing Company, Victory, N. Y., which position was the culmination of a continuous service of about fifty-three years. Poor health had interfered with his active employment for the past five years.

Business Items.

The Bath Grinder Company, Fitchburg, Mass., builder of the Bath grinder, states that its business has increased so in the past three months that it has had to double its capacity, and will now be able to furnish machines promptly.

The National-Acme Manufacturing Company, Cleveland, Ohio, announces the consolidation of its New York and Philadelphia offices, with location at 95 Liberty street, New York, under the management of L. M. Waite, formerly in charge of its Philadelphia office; S. G. Goodrich, assistant.

An order for four 4,000-kilowatt, three-phase, 60-cycle, 6,600-volt, alternating-current generators, with exciters, has just been placed with the Crocker-Wheeler Company, Ampere, N. J., by the trustees of the Sanitary District of Chicago. These are to be driven by Wellman-Seaver-Morgan horizontal water-wheels and put in operation at Lockport, Ill., the western end of the Chicago sanitary and ship canal.

James A. and John J. Tuohy have started in the machine tool business, with offices in the Engineering Building, 114-118 Liberty street, New York, under the firm name of Tuohy Brothers. We understand that they will do a general new machine tool business and carry a good line of second-hand machinery as well in stock. The Tuohy Brothers were with the Niles-Bement-Pond Company for several years and are well known among the trade.

Manufacturers.

The Reading (Pa.) Radiator Company will build a machine shop.

The Los Angeles (Cal.) Art Metal Works will erect a new plant.

The Electric Light Company at Redoak, Iowa, will increase its plant.

The Summit Stone Works, La Crosse, Wis., will make additions to its plant.

The Fisher Paper Box Company, St. Paul, Minn., will erect a $20,000 factory.

The Electrical Concrete Post Company, Lake City, Ia., will erect a factory.

The Buckeye Fence Machine Company, Ashtabula, O., will erect a plant shortly.

It is said that J. P. Raymond, of Oswego, N. Y., will build a foundry in Red Creek.

Meakins & Son's brush factory at Hamilton, Ont., has been burned; loss, $80,000.

H. Maddox, of Tioga, Fla., is putting in a foundry and machine shop at Archer, Fla.

The Goodell-Pratt Company, Greenfield, Mass., will shortly erect an addition to its plant.

Taylor Bros., Rochester, N. Y., are erecting a $75,000 building for their thermometer works.

The O. S. Kelly Western Manufacturing Company, Iowa City, Ia., will erect a new foundry.

A fire in the carriage factory of M. W. Quinlan, Brookline, Mass., caused a damage of $10,000.

The Norton Emery Wheel Company, Worcester, Mass., will make extensive additions to its plant.

The J. B. Morris Foundry Company, Cincinnati, O., will erect a pattern building, to cost $10,000.

The United States Steel Corporation is erecting a new sheet bar mill at its Columbus, O., plant.

Fire destroyed the barrel factory of the Armstrong Cooperage Company, Somerville, Mass.; loss, $15,000.

The plant of the Connellsville (Pa.) Machine & Car Company was recently destroyed by fire; loss $150,000.

A one-story plate iron plant is being erected by Fullerton & Bro., of Philadelphia, for Chas. W. Ervien & Co.

The Detroit (Mich.) Steel Casting Company, whose plant was recently burned, will build on a larger scale.

C. H. Holliday, who has a stove plant at Maryville, Tenn., is contemplating starting one in Middlesboro, Ky.

The Elizabeth City (N. C.) Hosiery Company will erect a yarn mill, to be equipped with all new machinery.

It is reported that the Boynton Scale & Pump Company, of Toledo, Iowa, is looking for a site in Des Moines.

It is reported that a mutual electric light company for Centerville, Iowa, is projected, and will seek a franchise.

The Tamaqua (Pa.) Light & Power Company has purchased a site for a plant to be completed by September 1.

The satinet mill of the Aldrich Manufacturing Company, Charlton City, Mass., has been burned; loss, $25,000.

The Washburn-Crosby Company, Minneapolis, Minn., will erect a machine shop and warehouse, to cost $20,000.

The Kansas National Drill & Manufacturing Company, Coffeyville, Kan., is establishing a branch in Tulsa, I. T.

The plant of the Chattahoochee Chemical & Mining Company, Girard, Ga., was destroyed by fire; loss, $25,000.

It is reported that a large power-house will be erected by the Pennsylvania Railroad Company at Weehawken, N. J.

The Columbus (O.) Heating & Ventilating Company, formerly the Vogelgesang Furnace Company, will erect a new plant.

The John W. Johnson laundry machinery plant at Upper Sandusky, O., was damaged by fire to an extent of $10,000.

It is reported that the Wason Manufacturing Company, Springfield, car builders, will erect shops at Clifton, N. J.

Postmaster Lewis and Charles A. Karmire will establish a factory in Shelbyville, Ind., for the manufacture of a farm gate.

A cannery is being contemplated for Anselma, Pa. J. C. Brownback, J. P. Emery, of Anselma, and others are interested.

J. F. Marks will erect a factory at Ballard, Wash., for the manufacture of wooden pipe. The total cost will be about $60,000.

The Emerson Manufacturing Company, Rockford, Ill., agricultural implements, will probably make additions to its plant.

The Bowen-Jewell Company, Jewell, La., will, it is said, remove to Chattanooga, Tenn., increasing the capacity of its textile plant.

The Salts Textile Manufacturing Company, Bridgeport, Conn., has prepared plans for the construction of an additional brick factory.

The Hanley-Casey Company, Chicago, Ill., engaged in the heating, plumbing and pipe-fitting business, will erect a $100,000 plant.

The Dana Manufacturing Company, Cincinnati, O., is going to build a $125,000 plant. This company manufactures ice-cream freezers.

The plant of the Hardie-Tynes Machine & Foundry Company, Birmingham, Ala., has been partially destroyed by fire; loss, $25,000.

The Western Sugar & Land Company will expend about $300,000 on additions and improvements to its plant at Grand Junction, Colo.

The Gibson-White Company, Chattanooga, Tenn., recently incorporated to carry on a general foundry business, will erect a factory.

The Windham Manufacturing Company, of Fall River, Mass., cotton cloths, will treble the capacity of its plant at Willimantic, Conn.

The Fort Wayne (Ind.) Builders' Supply Company recently incorporated, will make an addition to its factory and install new machines.

The Pacific Coast Borax Works, Bayonne, N. J., will erect two large factory buildings, which will be equipped with the latest machinery.

The Tulsa (I. T.) Foundry & Machine Company has been incorporated and will erect a plant for the manufacture of oil-well machinery.

The Clarkville (Ga.) Button Works has appointed a committee to investigate purchase of machinery for proposed finishing plant to be added.

The Van Bergh Silver Plate Company, Rochester, N. Y., is erecting a $50,000 factory, which will have its own electric lighting plant.

The Buchl Embroidery Company, Hasbrouck Heights, N. J., will erect an addition to its factory, to be equipped with modern machinery.

The factory of the American Cereal Company at Cedar Rapids, Ia., has been destroyed by fire, entailing a loss of about $1,500,000.

The Kemper-Paxton Mercantile Company, of Kansas City, Mo., will build a factory, to cost $80,000, for the manufacture of farm implements.

The plant of the White-Miller Extracting Company, Camden, N. J., dye stuffs, tanning preparations, has been destroyed by fire; loss, $50,000.

The Fort Wayne (Ind.) Plow Company will erect a factory. Architect Chas. H. Kendrick, Flick Building, will plan and supervise the work.

Stanley G. Flagg & Co., of Philadelphia, are perfecting plans for the erection of a new foundry, to take the place of the one burned, at Stowe, Pa.

It is reported that Efros & Co., Lakewood, N. J., have purchased land in Muldoon, Tex., where they will erect a factory for the manufacture of crockery.

The straw-board paper mills of John Leggett & Son, at Middle Grove, N. Y., have been burned, entailing a loss of $50,000. They will be rebuilt.

The H. L. Seabright Company, Wheeling, W. Va., has been incorporated and will improve an existing plant for the manufacture of building materials.

The Montreal plant of the Cobban Manufacturing Company, of Toronto, was damaged by fire to an extent of $30,000. This company makes moldings, etc.

A bill has been introduced in the Legislature at the instance of Mayor Thomas Brady, of Bayonne, N. J., authorizing the city to erect an electric light and power plant.

A new factory where all kinds of ornamental iron work will be produced will shortly be established in Winnipeg, Man. A. R. Taggart, of Selkirk avenue, is one of the promoters.

The General Engine Company has been incorporated and will erect machine shops in Portland, Ore., for the manufacture of a rotary engine invented by William Hoffman, of Buffalo, N. Y.

In our March 9 issue we published an item to the effect that the Williams-Abbott Company, of Cleveland, would establish a branch

factory at Cadiz, O. We are since informed this is an error.

The Bintliff Manufacturing Company, Minneapolis, Minn., whose plant was burned some time ago, will erect a new building, to be equipped with the latest machinery for making moldings and picture frames.

It is reported that seventy-six independent cotton oil mills of Mississippi have formed a joint stock company, capitalized at $500,000, and will establish a refinery, presumably in Jackson. N. H. Madden, of Yazoo City, Miss., is interested.

The Ball & Wood Company will enlarge its plant at Elizabeth, N. J., and move the pipe foundry from Phillipsburg to the former place. It is said the cost of the improvements will be $1,000,000 and there will be employment for a great many more men.

Wyman & Gordon, Worcester, Mass., will make extensive additions to their plant, which will include a forge shop, a building for heating and annealing furnaces and a storage building. New furnaces will be required and some new machinery probably put in.

The Otis Elevator Company, Hamilton, Ontario, has bought out the Hamilton Elevator Company, of Toronto, it is said, and this will mean that there will be in the near future a doubling of the Hamilton plant at the foot of Victoria avenue. New buildings will have to be erected and the staff will be largely increased.

A company, capitalized at $100,000, has been formed in Denver, Colo., for the manufacture of a gas fixture, the invention of H. W. Gremmels, of that city. Branch factories will be located in Fort Wayne, Ind., and Rockford, Ill. A. Moore Berry, P. A. Balcom, F. R. Tuttle, of Denver, and others are interested.

Walter Baker & Co. are figuring on the erection of a power-house at their plant in Milton Lower Mills, Mass. Besides the large brick buildings and high stack, there are included electric drive, two 1,200 horse-power engines and generators, two 150 horse-power engines and seven 200 horse-power boilers. Dean & Main, 53 State street, Boston, are the engineers.

The Peacock Iron Works, Selma, Ala., seeking a new location, has sent out an interesting circular from which the following is extracted: "We have been in this same business, in this same town, since 1865 (Mr. George Peacock, our father, and the founder of this business, having been brought here during the civil war to make cannon for the Confederate States), and having been located at our present stand for thirty years, we have outgrown our quarters, and are cramped badly for room, and are therefore compelled to move. As we are compelled to move, we are seeking the most advantageous place in every respect and invite correspondence and propositions from cities or towns desiring a large and old established iron business. Our specialty is car wheels and cars of all sizes and kinds, and our trade extends to all parts of the United States, as well as foreign countries, and to all the different trades using cars, large or small, which makes us always busy and never dull or idle. We also do a general iron business of all kinds for the local trade, manufacturing the best stationary engine made in the United States, as well as sawmills and other machinery, building and all kinds of castings. We have large works and wish to triple our capacity, and are well and favorably known all over this country, also Mexico and Cuba. Have just filled a large order of nine car loads of cars and car wheels to the United States Government and are now figuring on a large requisition to go to Panama. If interested, write us."

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Light drop forgings to order in quantities. Remington Arms Company, Ilion, N. Y.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Screw machine work to order up to ⅞ in., in quantities. Remington Arms Company, Ilion, N. Y.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

Wanted—Second-hand milling machine; state make and lowest price for cash. Address Edwin Ball, 31 Spruce st., New York City.

Wanted—Agents in every shop to sell a few simple remedies, mechanical preparations and hand paste. A. T. Ogden, 21 Mill st., Poughkeepsie, N. Y.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

Up-to-date plant, equipped for manufacture of medium size machinery, will take contract for automatic or interchangeable machinery on which careful work is desired. Box 396, AMERICAN MACHINIST.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, gray, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

Factory Accommodation for Rent.—American manufacturers desiring to open manufacturing branches in Canada can secure accommodation from the undersigned. Steam heat, electric light and power, natural gas, railway switches at door. Abundant labor. Write for particulars. State what you want. The Mill Properties Company, Limited, Dundas, Canada.

For Sale.

For Sale—Long-established machine shop in this thriving city; cause of sale, death in firm. W. D. Judson, New Haven, Conn.

For Sale—Foundry and machine shop; splendid location; two railroads, two rivers; no other foundry within 25 miles. H. H. Mason, Mt. Carmel, Ill.

Barnes 11 in. swing, foot-power lathe for sale; used two months; in good condition; power cross feed, compound rest, etc.; price $50 cash. W. H. Wood, Harrisburg, Pa.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send descripton, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CANADA.

Mechanical engineer, technical graduate, expert designer (age 31), desires position as engineer, superintendent or assistant; 9 years' experience; 2 years chief draftsman; up-to-date Canadian; capable of taking entire charge. Box 434, AMER. MACHINIST.

ILLINOIS.

Permanent position, by quick estimator and competent designer of inventive and executive ability; traveling cranes, elevators and general hoisting machinery; qualified to start concern in these branches; references; location immaterial; technical education. Box 273, AMERICAN MACHINIST.

INDIANA.

Mechanical engineer and technical graduate (age 26) wants position as engineer, assistant engineer or superintendent, after April 1st; inquiries solicited stating particulars. Box 441, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical draftsman wishes position. Address Box 419, AMERICAN MACHINIST.

Responsible position by technical man, age 34, experienced in shop and drafting room. Address Box 404, AMERICAN MACHINIST.

Competent and reliable model and experimental man, not devoid of original ideas, strictly temperate, desires a position after April 1; visible typewriters a specialty. Box 452, AMERICAN MACHINIST.

NEW JERSEY.

Foreman patternmaker desires position; is also draftsman; A1 reference. Box 427, AMERICAN MACHINIST.

Cost clerk, experienced, desires position within 50 miles of New York; references. Address Box 437, AMERICAN MACHINIST.

Draftsman, mechanical, 2½ years' experience, desires position, manufacturing or commercial; this vicinity. Box 445, AM. MACH.

Young man (24), technical education, with practical work in the shop, field and drawing room, desires position that will lead to salesman. Box 425, AMERICAN MACHINIST.

Detail mechanical draftsman, with 6 years' experience on printing and electrical machinery, shop experience, desires position; references. Box 428, AMERICAN MACHINIST.

NEW YORK.

Draftsman on general details; 4 years' shop experience. Box 446, AMER. MACH.

Mechanic and draftsman, age 24, ambitious, wants position; $21 per week. Box 444, AMERICAN MACHINIST.

Mechanical draftsman; good designer of gas engines; age 24; salary $21. Box 431, AMERICAN MACHINIST.

Mechanical draftsman, age 24, for detailing out and tracing, desires position. Box 447, AMERICAN MACHINIST.

Milling machine man, 14 years' experience, desires change of position; would take charge. Box 423, AMERICAN MACHINIST.

Mechanical draftsman (graduate), with shop and office practice, desires position. Address Box 457, AMERICAN MACHINIST.

Machinist and diemaker, A1, age 48, German, wants steady position; city or country. Address Box 433, AMERICAN MACHINIST.

Draftsman, 25; graduate German university; experienced in general machinery; salary $18 Box 456, AMERICAN MACHINIST.

Position wanted as chief draftsman or designer; steam and gas engines and air compressors. Box 451, AMERICAN MACHINIST.

Have had many years' experience drafting, patternmaking; would like position where the combination is desirable. Box 436, AM. M.

Position wanted by mechanical and electrical engineer, familiar with gas engines and D. C. and A. C. motors and dynamos, as draftsman or assistant engineer in power plants. Box 455, AMERICAN MACHINIST.

Expert designer of special tools and automatic machinery; qualified for position of chief draftsman if desired; minimum $35 per week; 15 years' shop and drawing-room experience. Address Box 443, AMER. MACH.

I have experience as designer, patentee and manufacturing, typewriters, typewriter adding machines, adding machines and automatic machinery; want situation as superintendent or draftsman and designer. Address Box 442, AMERICAN MACHINIST.

PENNSYLVANIA.

Draftsman, 9 years at steam and gas engines, pumps, hydraulic and general machinery, wants situation; technical graduate. Box 440, AMERICAN MACHINIST.

Cost clerk, at present employed, desires change of location; Southern States preferred; references furnished. Address C. R. L., care AMERICAN MACHINIST.

Mechanical engineer and designer; 20 years' experience; machine tools, hydraulic and structural shop machinery; plant design and improvement. Box 401, AMER. MACH.

As manager or salesman; thoroughly familiar with road and office work; covered large

The Layout and Construction of Cams—III.

BY CHARLES F. SMITH.

LAYING OUT AN ACTUAL FACE CAM.

To illustrate the layout of an actual face cam, No. 3, *stripper moves full forward* will be shown, this being the cam which strips the link from the plugs over which the ends are bent. The cam and its relation with the machine frame are shown in Fig. 19. It is the third cam from the large gear wheel in Fig. 3. It moves a slide *a* by means of a fulcrumed lever *b*, the position of the roller center being at *c* on an arc which is laid out to pass thru the center of the cam shaft, as already advised in connection with Fig. 9.

The diameter of the cam disk being that of which the length of the chart is the circumference, we draw the outer circle of the cam and lay down the thickness of the outer retaining wall, ¾ inch, and the radius of the roller, also ¾ inch, and draw the arc *n o*. The hight of the cam curve above the base line of the chart, 1¾ inches, gives the radial movement of the roller, and we lay it down as shown and draw the arc *p q*, giving the inner limit of movement of the roller center. The throw circle is next drawn in and divided as has been described and arcs from the feet of the perpendiculars from the division points are drawn. The arc thru the center of the throw circle gives, by its intersection with the arc struck from the fulcrum *h* of the lever as a center, the location of the mid-position *c* of the roller. In the present case this happens also to be the middle of the return curve of the cam, but this is accidental.

Consulting the chart, we find that the roller of this cam must begin its movement 270 degrees after the beginning of the feeding inward of the wire, the foot of the cam curve lying on the line which is 270 degrees removed from the zero line. The chart also informs us that the working movement of the roller must be made during 40 degrees of movement of the cam. Measuring back, therefore, 270 and 40 degrees from the position *c* of the roller, as shown, we determine the positions of the arcs on which the beginning and ending of the cam curve must lie. Drawing an arc *d e* from the center of the cam shaft as a center, and passing thru the center *h* of the lever fulcrum, we take its radius *h i* in the tram and find centers *f g* from which to strike arcs *j k* and *l m* passing thru the cam shaft center and the 270- and 40-degree points. These arcs, by their intersections with *n o* and *p q*, determine the position of the cam curve for beginning and ending the movement. Dividing the arc *f g* as before, we find points 1, 2, 3, etc., from which to strike arcs 1, 2, 3, etc., which by their intersections with the arcs from the feet of the perpendiculars thru the divisions of the throw circle give the successive positions of the roller center. From these centers circles having a radius equal to that of the roller define the cam groove. The return movement is laid out in the same way and from the same stroke circle, and is thus the same as the acting movement, altho the two cam curves are very different. Those portions of the groove which represent dwells of the roller are of course arcs of circles having the center of the cam shaft as centers, and are drawn in.

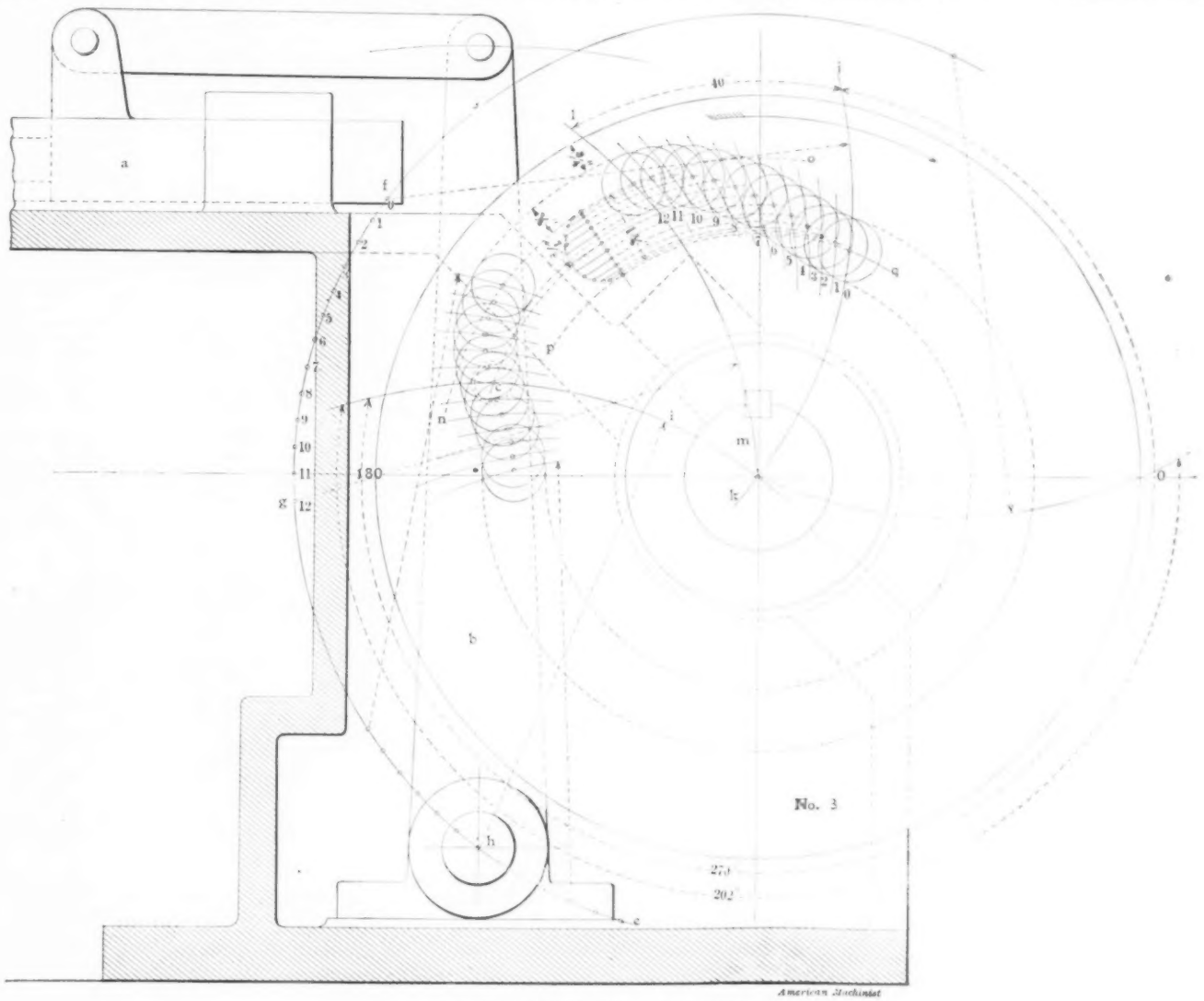


FIG. 19. LAYING OUT A DISK CAM.

LOCATING THE ZEROS OF THE INDIVIDUAL CAMS.

The zero of the chart should be looked upon as the zero of action and not, in general, of position of the cams; that is, the beginning of each cam curve is located the number of degrees behind the beginning of the feeding in of the wire that the movement of the cam must begin behind the movement of the wire. It is also the zero of position of the wire feeding crank and were the rollers all located in the angular position of this crank at the beginning of its movement, it would also be the zero of position of the cams. Convenience, however, makes it necessary to locate the rollers in various positions around the shaft and thus to change the zeros of position of their cams.

The zero position of the wire feeding crank is the outer center which is in the horizontal center line, and this point has been marked as zero in Fig. 19—that is to say, the zero of Fig. 19 is the zero of the chart. The effect of measuring back from the position of the roller the number of degrees which the chart shows the cam to act behind the beginning of the movement of the wire, locates the cam on the drawing in the position which it must occupy when the movement of the wire begins. The angular distance from the zero to the position *c* of the roller is therefore the angle by which the zero of position of the cam differs from the zero of action as shown on the chart, and measuring it, we find it to be 202 degrees and we draw a vertical line *stripper* on the chart at this angle. This plan is followed with all the cams and the horizontal center lines therefore locate the individual zeros from which the cams are located on the machine.

TRANSFERRING THE CAM GROOVE PROFILE TO THE TEMPLET.

The form of the cam groove is now determined, and it remains to show how this form is transferred from drawing to templet, to former and to the cam blank, and how the location of the keyseat is determined, for I never use set-screws to locate cams upon their shafts, as it is perfectly easy to locate the keyseats in advance.

The process of transferring the outline of the groove to the templet is shown in Fig. 20, which, however, does not show cam 3, of which the layout was given in Fig. 19, but cam 11 which, as shown by the chart, passes the twisted link thru the previously formed complete link pre-

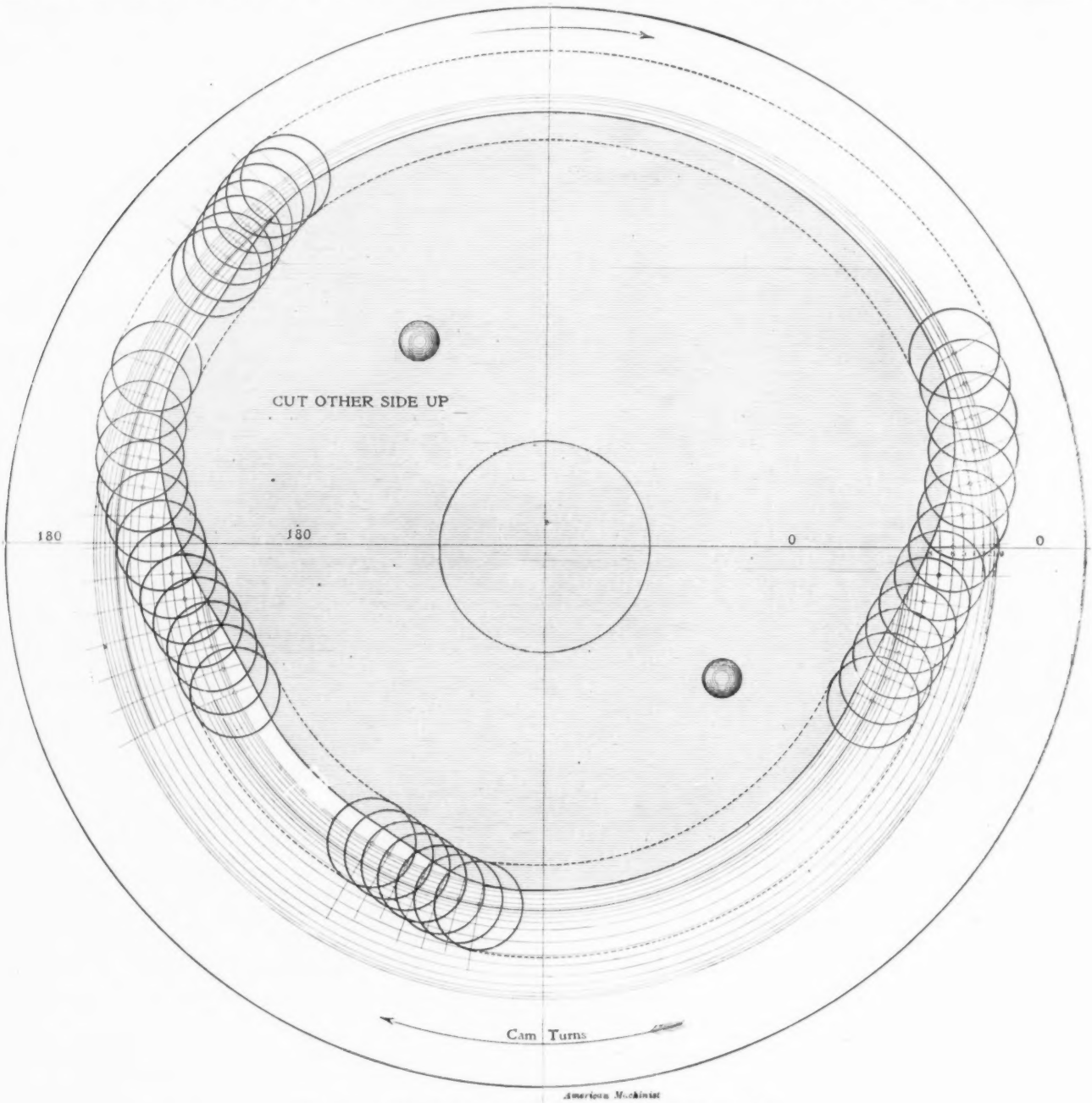


FIG. 20. TRANSFERRING THE CAM PROFILE TO THE TEMPLET.

vious to bending. The selection of a different cam is perhaps of advantage, as it lends variety to the explanations.

A piece of thin sheet metal, for which I prefer zink as it takes the lines readily, is tacked down on the drawing as shown by the shaded outline. This sheet is previously cut to a shape which shall fall within the pitch line of the cam groove but without the inner border of the groove. Its form is easily determined by laying a piece of tracing paper over the drawing and then drawing freehand a line which shall mark the desired outline of the zink. The paper is then trimmed to this line and is used as a templet to which to cut the zink.

With the zink tacked over the drawing the horizontal and vertical center lines are carefully drawn with a fine, sharp scriber and then with a pair of dividers having fine, sharp points, those portions of the roller circles which are covered up by the zink are redrawn on the zink. With an irregular curve the bounding line of these arcs is then drawn, tho not shown in the illustration, the circular portion of the groove which represents dwells of the cam roller being drawn with the dividers from the center of the zink as located by the center lines.

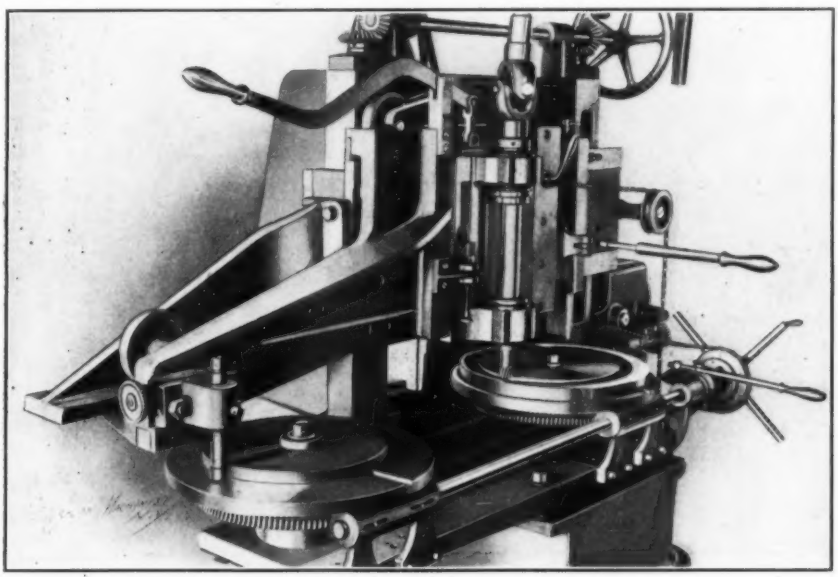


FIG. 21. MILLING A FACE CAM.

The extremities of the horizontal center line on the templet are marked 0 and 180 in order to properly locate the templet on the former blank after the zero has been located on the blank, as will be described later.

MAKING THE FORMER.

The outline completed the metal is carefully dressed down by hand to the outline and the templet is then placed upon the former blank which has previously been faced off. The center lines are drawn on the former blank and marked as on the drawing and templet and the outline is then transferred to the blank by a fine, sharp scriber, and the former is then dressed down to this line, the bulk of the metal being removed in a milling machine. The circular portions of the outline are easily followed exactly and the other portions are followed as closely as possible, after which they are dressed down to the outline as carefully as possible by hand.

The reader will observe that the cam curve is in this case drawn in dotted lines because of the fact that the roller, and hence the groove, are for this case on the far side of the cam. Were they on the near side the fact would be shown by drawing the curves in full lines. With the curve on the near side the templet would of course be laid on the former blank in the position in which it was laid out, whereas with the curve on the opposite side the templet must be turned the opposite side up. This is noted on the templet before it is removed from the board by the words *cut other side up*, as shown. The point of view when drawing all the cam curves should be from the same end of the shaft.

KEYSEATING THE SHAFTS.

Before doing any work in cutting the cam groove the shafts are keyseated, as are also the cam blanks. In order to locate the keyseats in the shafts they are assembled in the machine with the connecting gears keyed to them, together with the wire feeding crank, which is placed at the zero position. The mating teeth of the gears which connect the shafts are marked so that they may be reassembled at any future time in the same relation, and the keyseat is located by a surface gage and scriber. The bottom surface of the main bed, Fig. 19, is planed and parallel strips projecting out under and beyond the cam shaft are bolted to it. On these strips additional long parallels are laid, thus locating a base line which is truly parallel with the shafts. A surface gage supported on these strips is then used to locate the keyseat the entire length of both shafts. The actual location of this line around the shaft is unimportant, but I prefer, for the sake of uniformity, to locate it on the exact top of the shaft, as indicated in Fig. 19. The keyseats located, the shafts are removed and the seats are cut. To key the cams to the shafts, I make the keys parallel and a sliding fit and secure them and the cams from displacement endwise by set-screws bearing on the keys.

KEYSEATING THE CAM BLANKS AND LOCATING THEIR ZEROS.

The cam blanks are then keyseated, the location of the keyseats being of no importance, as the forms of the cams do not yet appear upon them. The blanks being numbered in accordance with the scheme of numbering shown on the general drawing and chart, they are placed on the shafts in their correct order, *keyed thereto*, and the shafts with the blanks are replaced in the machine preparatory to locating the zeros on the blanks.

To locate the zeros the parallels and surface gage already described are again used. The wire feeding crank is located on its center and the surface gage is adjusted to the exact center of the shaft and then carried around the machine scribing a line on each blank, which is obviously truly horizontal with the centers of the shafts, and hence corresponds to the zeros of the chart and of the cam drawings, as shown in Fig. 19. These lines are scribed across the perifery of all blanks and also on the faces of the face cam blanks, and are stamped zero in all cases.

Turning back to Fig. 19, it will be recalled that the corresponding horizontal zero line has been located in the drawing and transferred from there to the templet and to the former, and it only remains to place the former and cam back in the milling machine in the proper relation to insure a correct cam.

MILLING THE CAM.

In the case of a face cam this is insured in the following manner: A cam blank and its former are placed on an arbor, and the zero lines are made to match, when a hole is drilled thru both pieces. The face-plates of the cam-cutting machine have pins adjustable radially, but in the same relation circumferentially, and by placing former and cam blank on their appropriate face-plates with the pins entering the respective holes, the correct relation of the two is insured.

Fig. 21 shows a face cam and its former in position in the milling machine, which is a Garvin profiling machine with a cam cutting attachment. The slots in the face-plates which carry the pins entering the drilled holes in former and blank are plainly shown. The former and cam blank are geared together so as to rotate in unison, the former having a roller of the same size as the milling cutter and future cam roller pressed against it by a weight at the right, hung from the chain shown.

Both roller and cutter are carried by the profiler head, and as the former and blank rotate it is obvious that the outline of the former will be reproduced on the cam. Several cuts are required to mill the groove, first to get the depth and then to complete the width—the finishing cutter of course taking a very light cut.

RETROSPECT.

Looking back, it is clear that the cam was laid out in the position which it has to occupy when the crank begins its movement and the horizontal zero was marked upon it. The templet copied the drawing and transferred it and its zero to the former. The cam blank was keyed to the shaft when its zero was marked upon it and the marking was done with the crank located in its zero position, and these positions must be repeated when the parts are reassembled. Finally, the position of the zero of the former as determined from the drawing was made to agree with the zero of the cam blank as taken when in the machine. This being done with all the cams it is plain that they must go to place and work as intended.

The layout and construction of perifery cams will be taken up in the next article.

The desire to save its natural gas for its own use is leading West Virginia to adopt legislation which violates the Federal Constitution. It is proposed to prohibit the piping of natural gas beyond the limits of the State. If the Federal Constitution settles anything, it is the principle of free trade between the States. An export tax upon articles carried from one State to another is not permissible. The suspension of the transportation of natural gas from one State to another would interfere with interstate commerce. It is said that such action is seriously considered. If it were constitutionally valid, retaliatory legislation prohibiting the exportation of certain articles into West Virginia could be enacted.

The United States Arsenal at Rock Island—VIII.

BY F. A. STANLEY.

What is stated to be the best field gun yet brought out in any country is the "3-inch model of 1902," adopted some time since by the United States War Department, this new field piece having a hydraulic cylinder which allows the gun, when fired, to recoil in its guide on the carriage, a feature which, in conjunction with the spade embedded in the earth at the end of the trail, and the weight of the carriage, prevents the wheels from jumping, and, with the improved facilities for manipulating the gun, makes it possible to hold the latter with ease on the target, and to load and fire the piece rapidly; from ten to twelve aimed shots per minute being possible in regular service, while for a brief period as many as twenty rounds per minute may be fired.

The new carriage is the design of Capt. Chas. B. Wheeler, of the Ordnance Department, and as fast as manufactured will, with its gun, replace the 3.2-inch field piece now in service. As noted in an earlier article, the manufacture of the carriage, caisson, etc., is one of the most important and interesting branches of work carried on at Rock Island Arsenal; and in the present paper some illustrations of this new field material are presented and some operations in connection with its construction described. This branch of arsenal work is supervised by Capt. George W. Burr—of the above department—under the direction of the commanding officer, Colonel Blunt.

In Fig. 57 the gun carriage is shown attached to its limber; Figs. 58 and 59 show the carriage with the gun in firing position and also in position of extreme recoil; Fig. 60 is a view of the limber with the ammunition chest open, and Fig. 61 illustrates the caisson, whose ammunition chest also is open in the rear view. A line drawing of gun and carriage is reproduced in Fig. 62, and this in connection with the half-tone will make the construction clear.

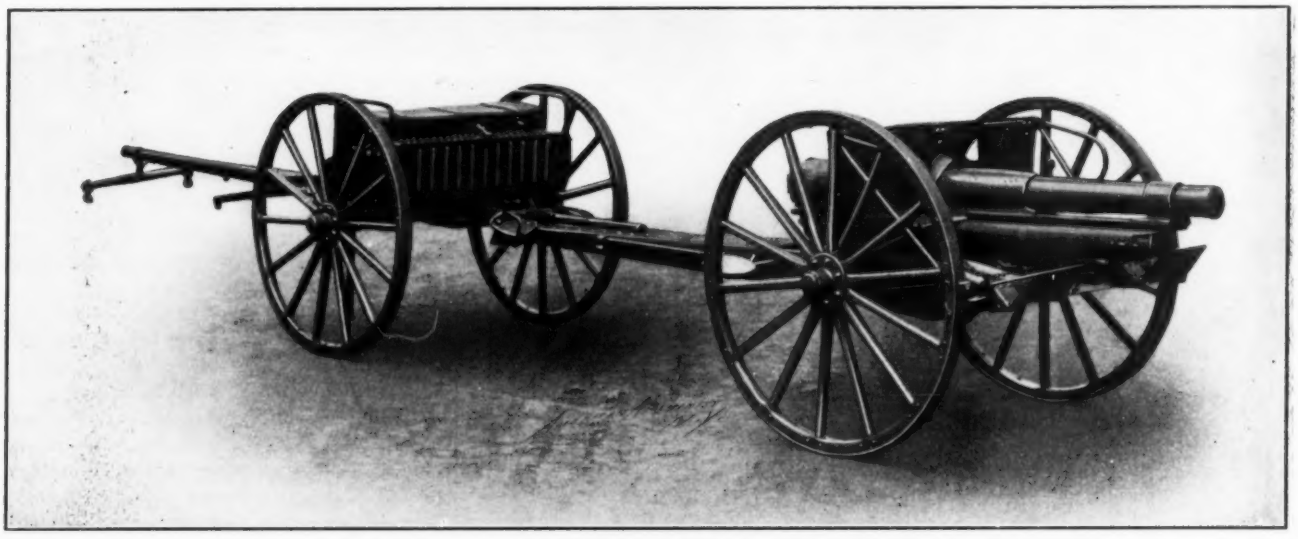


FIG. 57. 3-INCH FIELD CARRIAGE AND LIMBER.

THE GUN.

The gun itself is not made at Rock Island, but is sent there to be mounted on the carriage. It is a built-up nickel-steel rifle, 88 inches in length, with an interrupted-screw breech mechanism whose block may be opened or closed by a single movement of the lever at the rear, lever and block being connected, as indicated in the end view, by bevel gear teeth; and the block carries an eccentrically located firing pin, which—to prevent premature discharge due to a broken pin—cannot come into line with the primer until the block is turned to close the breech. The operation of opening and closing the breech cocks the piece, and the mechanism is so constructed that it is impossible for the sear to be released unless the block is closed. The extractor ring, which may be seen in the longitudinal section, fits under the cartridge head at opposite points and is guided in grooves formed in the breech. The gun is fired by means of a handle shown at the right-hand side and which can operate the sear only when the gun is well returned to battery. The projectile thrown weighs 15 pounds, and the maximum range is about 7,500 yards.

THE GUN CARRIAGE.

The method of attaching gun to cradle and cradle to carriage proper will be understood from the line drawing. The carriage, which weighs independent of the gun about 1,300 pounds, is a strong and carefully built vehicle constructed on the interchangeable system with various parts made to limit gages, and, like limber and caisson, it is fitted with a hollow axle, and has wheels of large diameter for easy traction, these having dust-proof boxes

which are automatically supplied with lubricant from the chamber in the axle.

The cradle, as shown at *A*, is provided at the top with a bronze-lined flange forming a guide for the gun in recoil, and its sheet steel body encloses the recoil cylinder *B* and counter-recoil springs *C*. To the under side is riveted pintle *D* fitting a socket in rocker *E*, and by means of screw and nut *F* the piece may be traversed, or swiveled about the pivotal point, thru an angle of 8 degrees; and thru elevating gear and double screw *G* acting upon the end of the rocker it may be given any elevation up to 15 degrees. The bracket for the elevating gear is housed in the trail *H*, to which the cradle may be locked when the carriage is in motion, thus taking the strain from the elevating and traversing mechanism. The trail is formed of two steel channels drawn up under hydraulic pressure and held together by cross pieces and plates as shown in the half-tone engravings of the carriage. At its rear end will be noticed the spade, with two wings which prevent its sinking too deeply into the earth; the folding hand-spike, and the ring for connecting with the limber. A tool box is provided near the center of the trail, and just beneath the rear end of the gun a pair of seats are attached for the use of the gunners operating the piece.

The recoil cylinder *B*, Fig. 62, is firmly fixed at its rear end to a lug depending from the gun; and the front end of piston rod *I*, which passes thru a stuffing-box in the front of the cylinder, is attached to the head of the cradle. Encircling the cylinder is the counter-recoil spring *C* which returns the piece to battery after firing, and which is really made up of

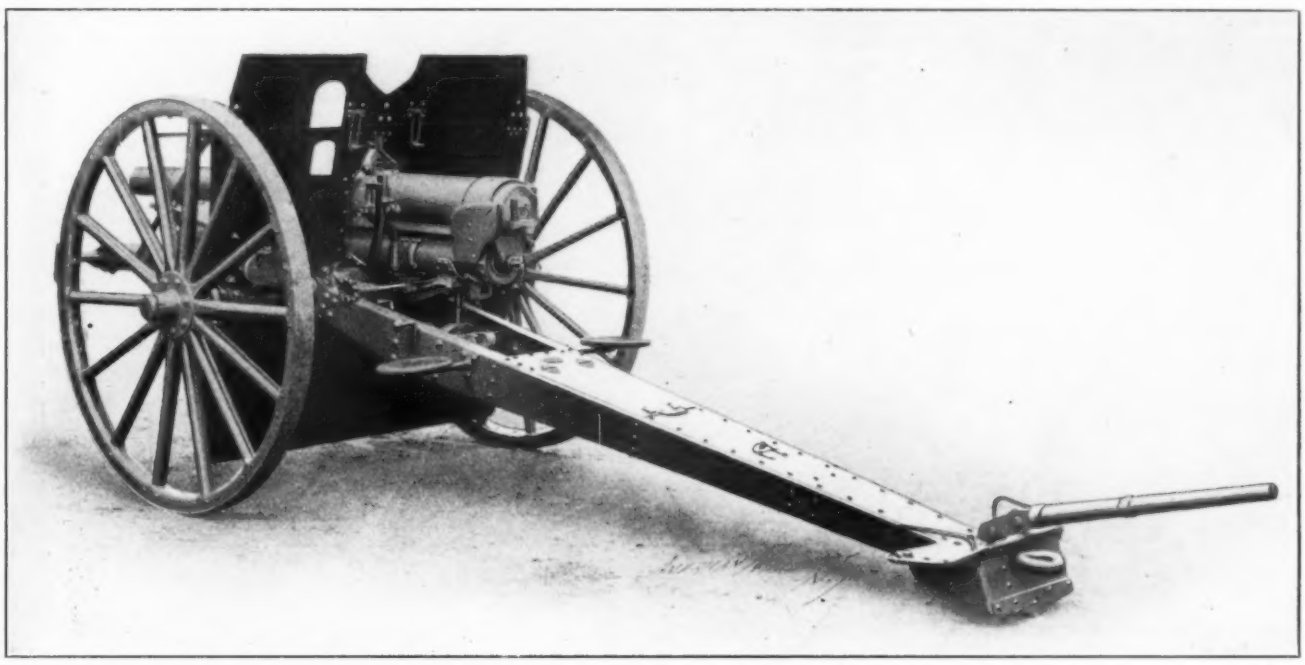


FIG. 58. CARRIAGE, WITH GUN IN FIRING POSITION.

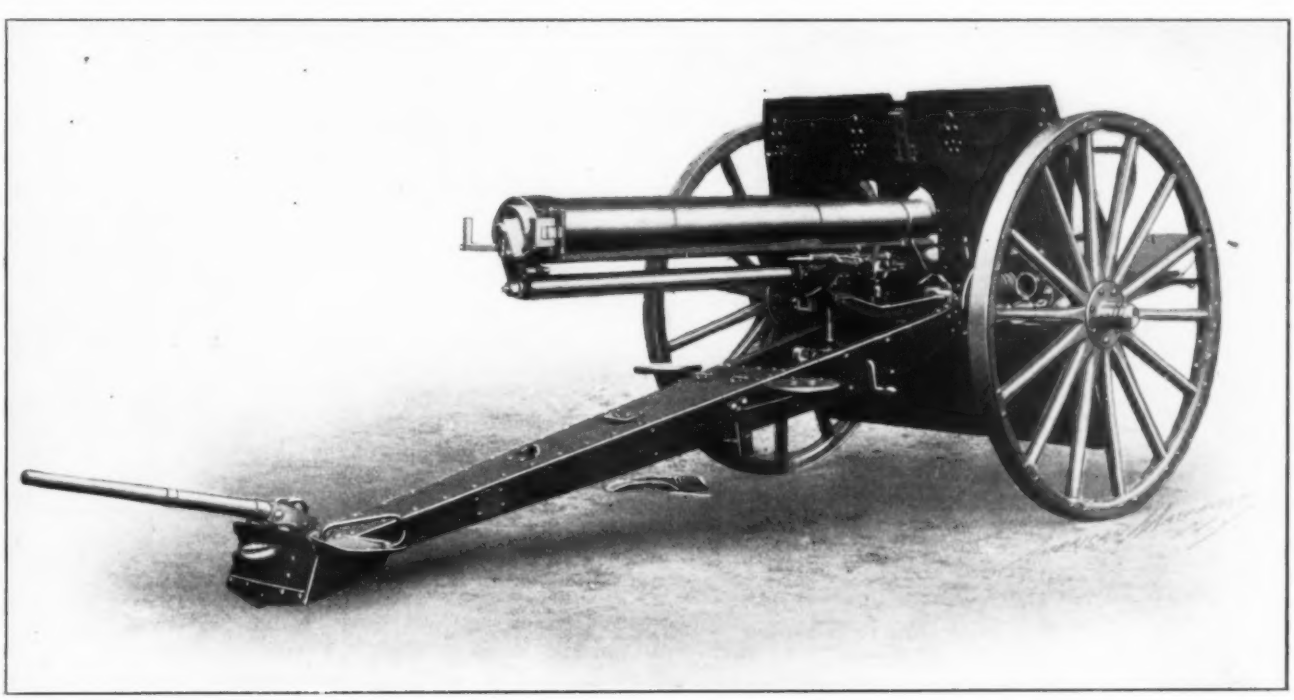


FIG. 59. CARRIAGE, WITH GUN IN RECOIL.

three springs of equal length placed end to end in the casing. As shown in the sections thru gun and cradle, the cylinder is provided internally with three longitudinal lands or ribs and the piston head *J* with three grooves of corresponding width. The ribs vary in hight from end to end—coming almost flush with the bore toward the rear, while the front ends are much higher—and thus serve as throttling bars for the liquid which is carried in the cylinder and which must pass thru the notched ports in the piston head as the gun recoils and the cylinder slides back with it over the stationary piston. The top of each of the throttling ribs is really a curve controlling properly the piston port area so as to make the total resistance of liquid and springs such that when the gun is fired in horizontal position the wheels will not leave the ground.

The travel of the gun in recoil is 45 inches, and during this rearward movement of gun and cylinder the springs are of course compressed ready to return the gun to battery—a movement controlled by the counter recoil buffer *K*, which is a very slightly tapered rod traveling with the recoil cylinder and entering freely in the chamber formed in the piston rod. As will be noticed, the springs are of thin section and coiled edgewise, the stiff steel stock being about .2 inch thick by 1⅜ inches wide. The outside diameter of the coil measures nearly 6 inches, and each of the three springs, when free, is over 3 feet long. The spring column, as assembled in the cradle, has a total length of about 70 inches, and while admitting of a compression of 45 inches, is stiff enough to return the gun to battery when fired at 15 degrees elevation.

The men handling the gun are protected from small arm and shrapnel fire by a shield of .2-inch hardened plate, made in three sections, the main plate from the axle to the wheel top being fixed rigidly in place, while the apron below may be folded up under the foot-rest in front and the top plate swung down when the piece is not in action. The man on the right-hand seat operates the breech mechanism and does the firing, while the gunner on the left keeps his eye on the sight and manipulates the elevating and traversing handles. The sight standards are fixed to the left side of the cradle, and on the opposite side is a range quadrant, and as the elevating mechanism may be operated from either side thru the medium of the double crank handle, the gunner to the left can, if desired, attend merely to the traversing mechanism to keep the gun on the target while the man on the right looks after the elevation.

It will be seen from Fig. 57 that the carriage is provided with two seats for the cannoneers—one at either side of the gun—and with wheel guards, brakes and a pair of foot-rests, each of the latter being formed at the front ends of two ammunition tubes which extend to the rear of the shield, where their ends are closed with hinged lids, one of which is visible in Fig. 58. The four cartridges carried in these tubes are for use in case of emergency.

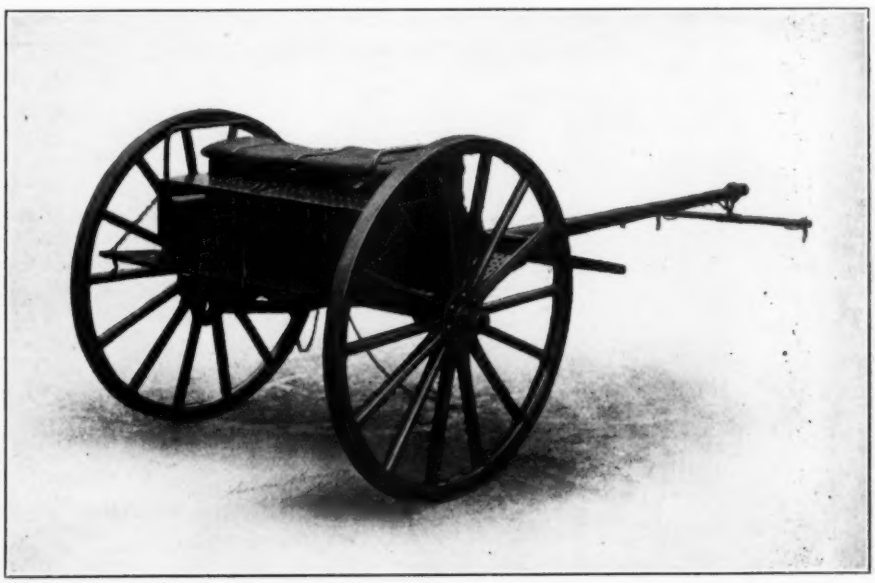


FIG. 60. THE LIMBER WITH AMMUNITION CHEST OPEN.

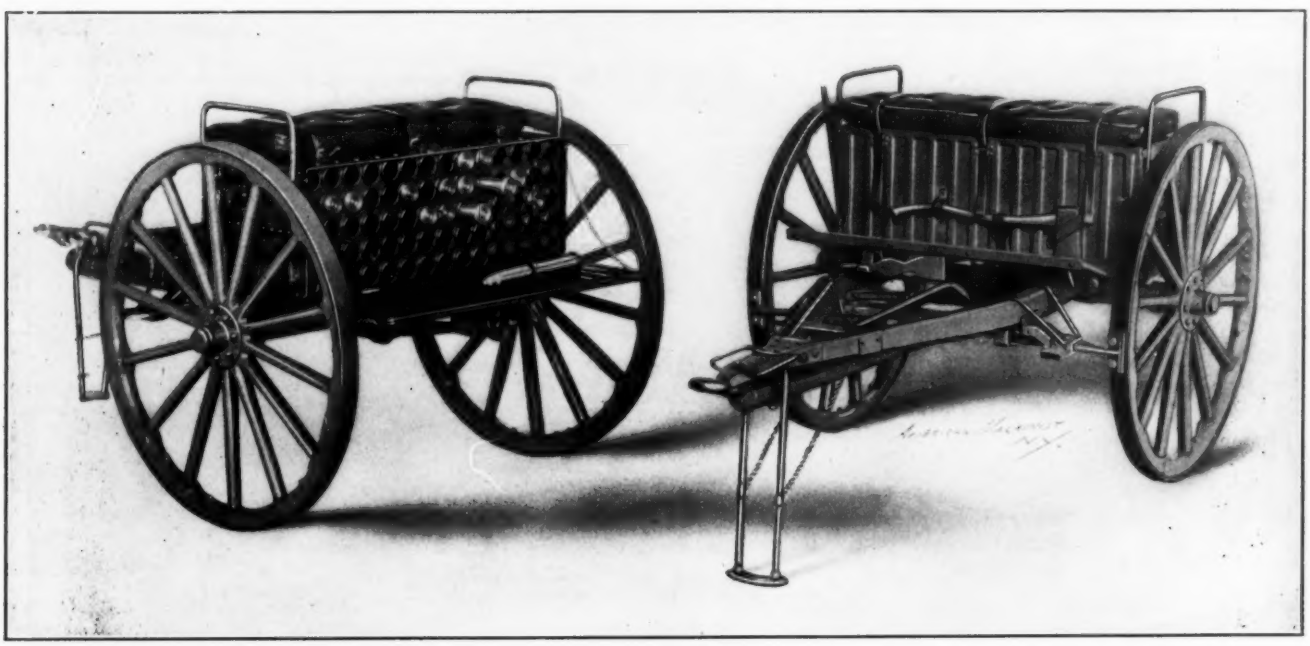


FIG. 61. THE CAISSON FROM FRONT AND REAR.

THE LIMBER AND CAISSON.

The limber shown in Figs. 57 and 60 is of metal, excepting pole and wheels, and

on its steel frame is secured an ammunition chest in which thirty-nine cartridges may be placed, in three rows of thirteen each, tho ordinarily three of the openings are reserved for oil cans. The chest has three vertical diaframs inside with the holes flanged, like the one at the rear, to receive the ammunition; and the corrugated door, which, when closed, holds the cartridge rims firmly against the flanges of the rear plate, may be let down level, as in Fig. 60, to form a convenient shelf during the handling of the ammunition. The top of the chest seats three men. A foot plate is attached in front, and provision is made for carrying an axe, shovel, pickaxe and other tools.

The caisson, Fig. 61, is of steel in all particulars, except the wheels, and has an ammunition chest which holds seventy rounds. The diamond-shaped frame of the vehicle is quite short, and several caissons may be coupled as trailers; the limber, of course, is the same as that for the gun carriage. The top of the ammunition chest provides a seat like that of the limber, and about the same equipment of tools is carried on the two vehicles. The weight of the caisson loaded is about 2,400 pounds, or 800 pounds more than that of the limber.

In the make-up of the new batteries there are four field guns and twelve caissons with the necessary limbers, giving the battery a total of 1,432 rounds of ammunition and each gun 358 rounds. Then there is a forge limber which carries in place of the ammunition chest, a forge and set of farrier's tools and machinist's tools; also a battery wagon, carrying carpenter's and harnessmaker's tools, extra wheels and many other spare parts.

SOME SHOP OPERATONS.

At page 179 an illustration of the hydraulic presses at the arsenal was presented, showing in the foreground a side rail for a caisson frame, and the die in which it was shaped. This piece, like some others, is quite an awkward one to handle—at least would be were it not for the special facilities adopted for the purpose. The dies are made up of heavy gray-iron base plates with die blocks of the proper shape attached at the points where the work is to be formed, and the piece is pressed into shape with the ram working very slowly so that the cold material, which is about 3-16 inch thick, is not injured. In such crooked work as the example shown, certain bends are made hot and the piece shaped up roughly on forms by the blacksmiths; then in the press the pieces are all brought up alike to the proper form.

Pretty much all the framework of the carriage, limber and caisson is handled under these presses, also the seats, foot rests, etc., and the various plates for the ammunition chests; the diaframs used in these being punched out and the flanges then formed about the holes by means of heavy die blocks in which the required number of tool-steel punches and dies have been inserted. Afterward the plates for the chest (about ⅛ inch thick) are taken to the machine shop where they are drilled

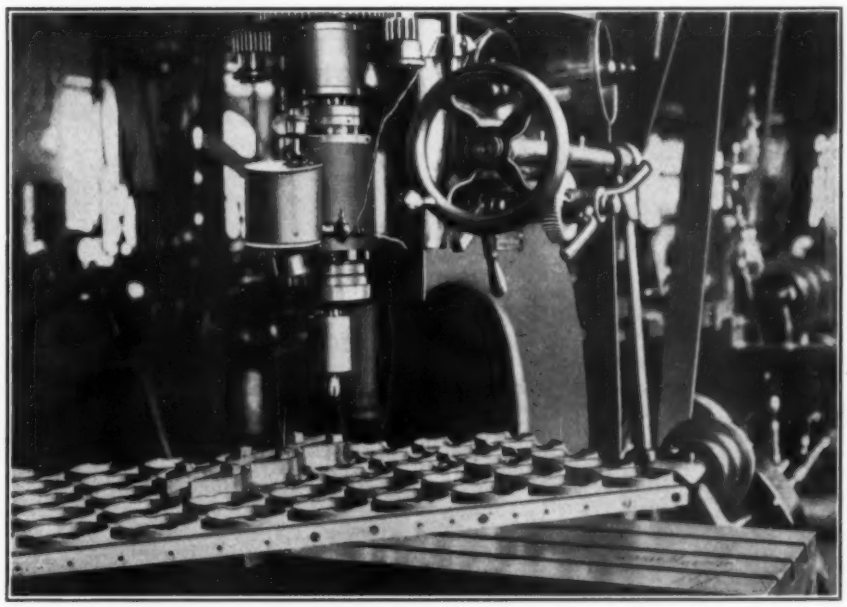


FIG. 63. MILLING NOTCHES IN AMMUNITION CHEST PLATES.

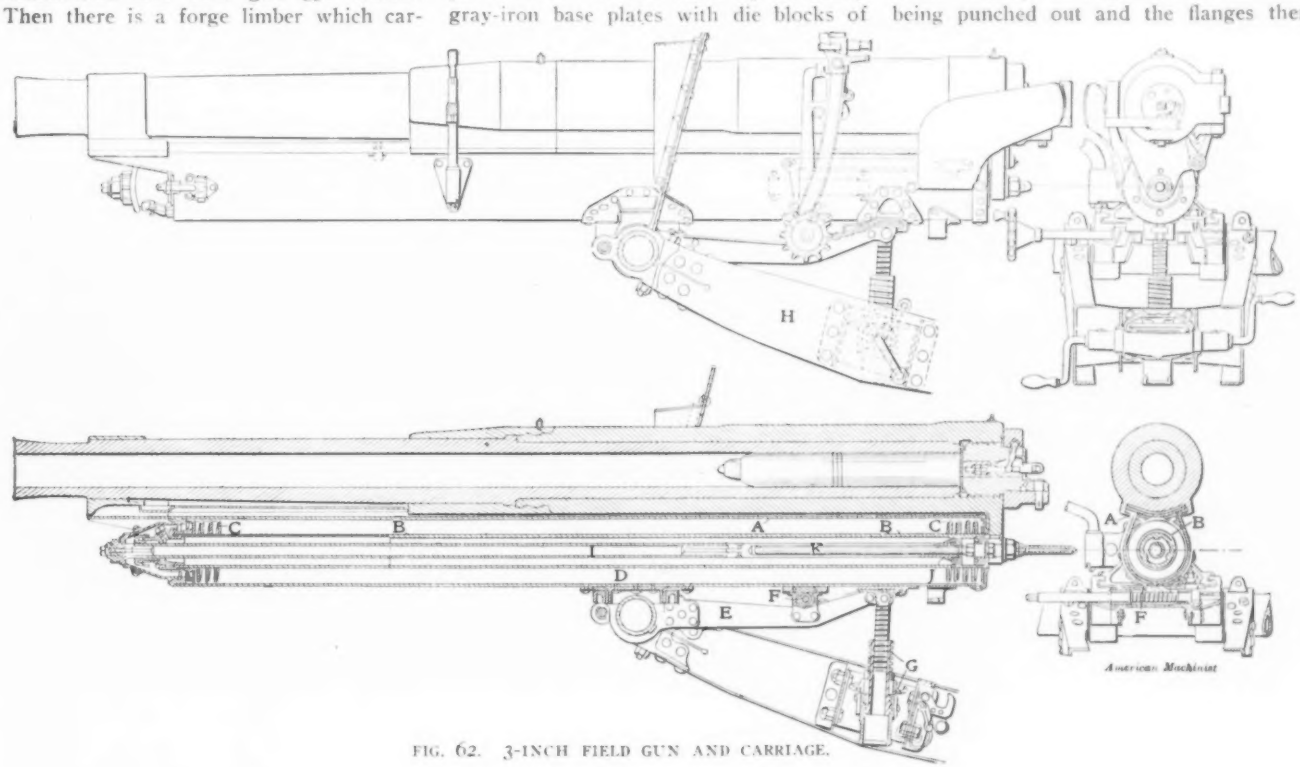


FIG. 62. 3-INCH FIELD GUN AND CARRIAGE.

in jigs to receive the rivets required in assembling. It is necessary that the rear plate in the chest should be provided with notches in the flanges about the holes in order that the cartridges may be readily removed with the fingers. Fig. 63 shows such a plate held on the table of a vertical spindle miller by a special clamping fixture while the notches are formed with an end mill. After the chest is assembled a reamer is run thru the openings in the diafram to insure the cartridges fitting properly.

MAKING HOLLOW AXLES.

The hollow axles (which are carefully tested when completed) are bored out considerably larger thru the body than at the ends; this is accomplished by boring out the forgings in the lathe from one end to the proper depth, after which the open end is closed down under the hammer in the forge shop, and both ends are then ready to turn taper and bore as soon as the body has been machined. As the axes of the conical bearings for the wheels do not coincide with the axis of the axle body, but are at such an angle as to bring the under side of the cones in a horizontal line, the lathe in which these ends are turned and bored is provided with a special chuck as represented in Fig. 64, which carries one end of the work off center while the other is being machined. During boring operations the outer end of the axle is steady rested; afterward the end is plugged and carried on the dead center, while the taper surface is finished and the groove cut which carries the wheel retaining collar.

MACHINING RECOIL CYLINDERS.

The recoil cylinder is approximately 3 inches outside diameter by 6 feet long, and after the outside is turned and a hole bored thru from end to end, the piece is placed in the lathe shown in Fig. 65, where three grooves are splined to depth, leaving the three ribs for the throttling bars, as already explained. The diameter at bottom of grooves is about 2½ inches, and the cutting away of the cylinder bore to depth is an interesting piece of splining. The work is held in a steady-rest and gripped by a special chuck which has worm teeth on its perifery, and is turned intermittently by an automatically controlled worm shaft below; the cone belt, of course, is thrown off. The cutter bar, supported as shown and provided with means of lubrication, is fed in and out by a pair of pulleys driven by open and crossed belts, which pulleys are mounted in a special head replacing the footstock, and actuate the feed nut for the bar. Rougher and finisher heads, easily changed, are provided for the bar, the former carrying three tools and the latter at the head. After each pass of the tool a puff of compressed air and a stream of soda water clean out the chips. The cutters are expanded to cut to depth by a scroll cap engaging with lugs on the tools.

The boring of the throttling curve in the cylinder is accomplished by the aid of the ingenious tool illustrated in the sketch, Fig. 66. The front end of the cylinder is grasped in a lathe chuck with the other end in a steady-rest, and the tool bar *A* is slipped thru with its inner end supported in hardened sleeve *B*, which fits in the end of the cylinder next the chuck, a steady-rest gripping the outer end of the bar and keeping it from turning with the work. Bronze sleeve *C* is a sliding fit on the cylinder, and of course rotates with it. Inside of the sleeve, however, is a second sleeve *D*, which is retained by the rings at either end and which does not rotate, altho it slides with *C* along the bar. The latter is slotted and carries a hardened

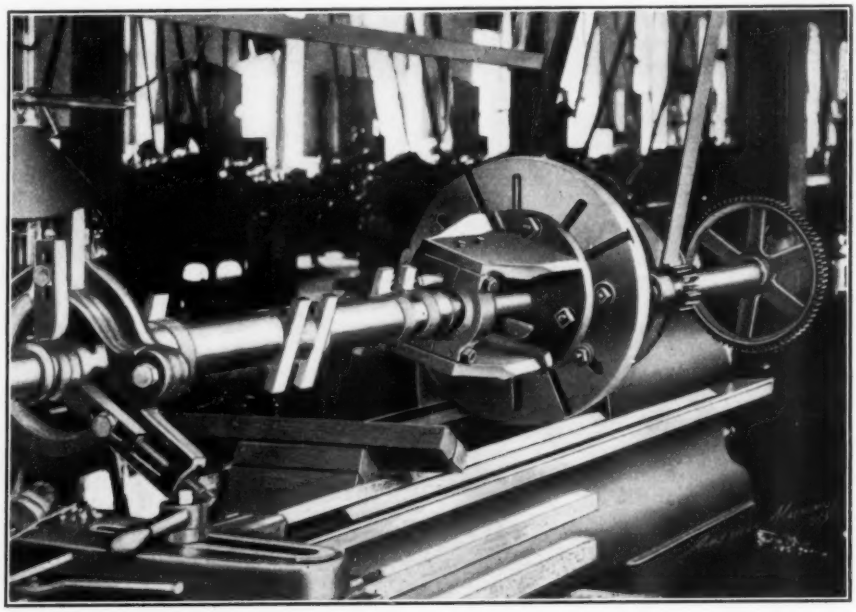


FIG. 64. LATHE RIGGED FOR MACHINING AXLES.

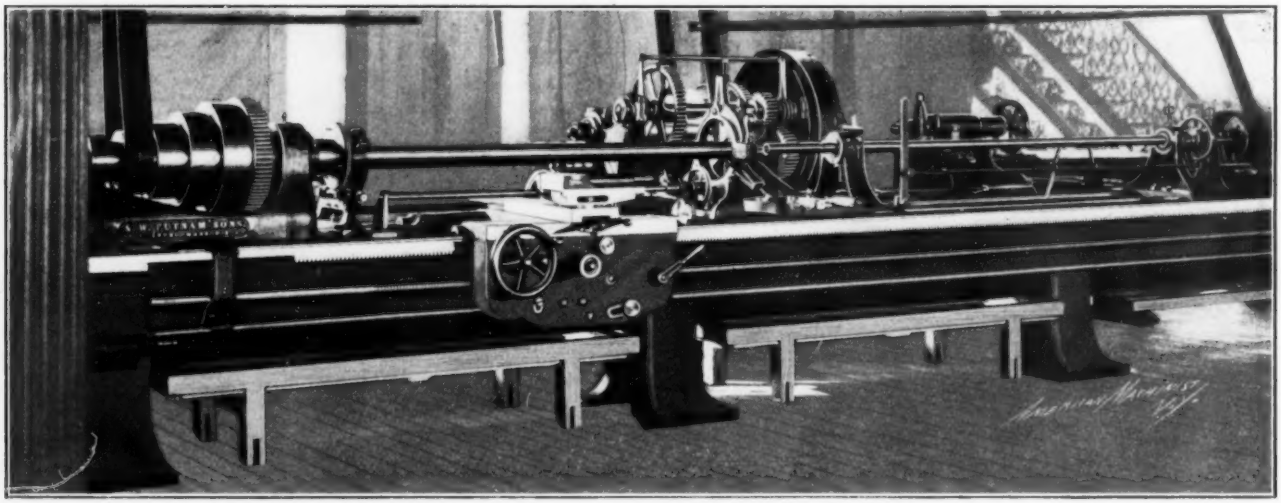


FIG. 65. LATHE FOR MACHINING RECOIL CYLINDERS.

guide bar or form E, with which tool F is kept in contact by the flat spring above, this tool being attached to the end of feed bar G, whose outer end is secured to the lathe carriage. On top of the feed bar is a thin strip of steel which is riveted to sleeve D. As the carriage is operated to feed the tool thru the work, bushing C slides along to support bar and tool, and the tops of the throttling bars are accurately shaped to correspond to former E. A number of cuts are taken, the operator dropping a longer boring tool into place for each fresh cut, and the cylinder, when finished, is a remarkably accurate piece of work; in fact the greatest error found in this peculiar bore in many cases is less than one thousandth of an inch.

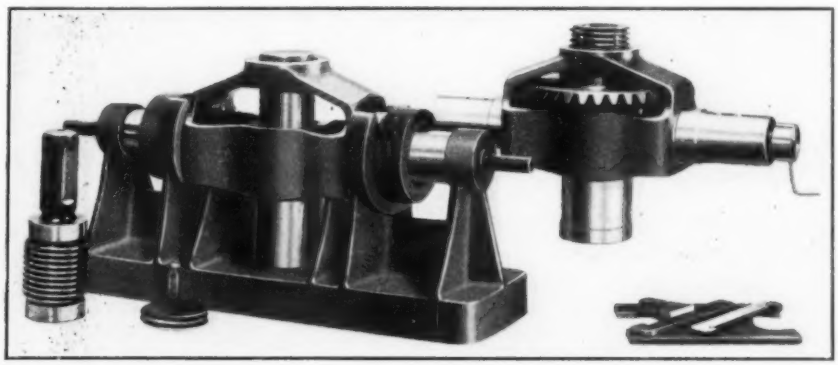


FIG. 67. GAGES FOR ELEVATING GEAR BRACKET.

FIELD CARRIAGE GAGES.

A few of the many gages used in this work are illustrated in Figs. 67 and 68. In the former view is represented a fixture for gaging the elevating gear bracket, and two of the brackets are also shown, the one not in the fixture having its gears and the outer member of the double elevating screw in place. The bracket is bored from the bottom, is threaded at the top for the combined screw and nut, has a pair of trunnions at the ends for mounting in the carriage trail, and in these trunnions holes are bored holes for the shafts by which the elevating mechanism is operated.

The gray-iron fixture has at the center a steel stud over which the bracket must fit, as represented. On the trunnions are slipped a pair of hardened ring gages, which must also slip into the pockets formed in the two intermediate lugs of the fixture. Then a pair of plug gages, fitting holes bored thru the two outer and two inner lugs of the fixture, are pushed thru lugs and trunnions. The different gaging points are already tested with independent gages, and at certain points a small amount of clearance is allowed between the bearings and the gages used in this fixture. However, this leeway is very slight in any case, and if the bracket is not just about right in all particulrs, it will not enter the fixture. The gears are tested by slipping in a stud to carry the pinion, a wire handle at the end of the stud forming a means by which the gears may be rotated.

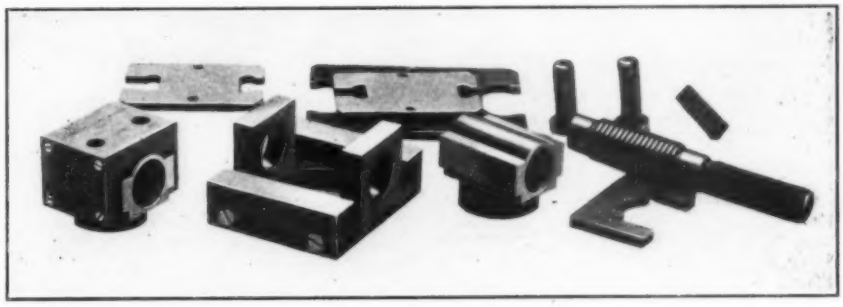


FIG. 68. GAGES FOR TRAVERSING NUT.

Fig. 68 (the final illustration in this series) shows a set of gages for the traversing nut by which the gun is swung about its pintle. This bronze nut has a hub fitting an opening in a link under the cradle and is adapted to slide in a guide formed in the rocker. The nut body, the threaded hole and the hub therefore should be of the right dimensions and the different surfaces properly located relative to one another. One of the nuts in the photograph is shown slipped into the gage for testing the body as a whole after various points have been tried with the limit gages. This part of the gage is dropped into the base just to the right, in which it is a nice fit, and the hub or boss formed on the nut should then enter the opening bored thru the base and the tapped hole permit the thread plug to be passed thru gage and nut.

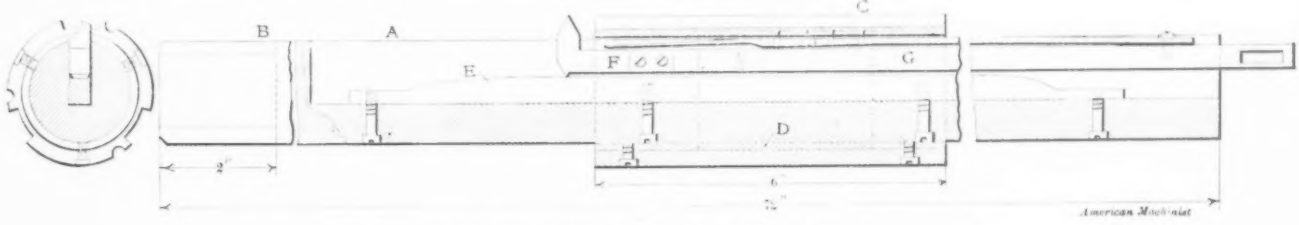


FIG. 66. RECOIL CYLINDER BORING TOOL.

A WORD IN CONCLUSION AS TO THE COST OF THE ARSENAL.

Before concluding this description of Rock Island Arsenal and its varied manufactures, a few words as to the cost of the immense plant with its machine equipment, adjacent water power, etc., would seem to be in order: Up to March, 1897, when Colonel Blunt was placed in command and by which time most of the buildings were already erected, a little less than nine million dollars had been expended, six and one-half millions of which represented the outlay for shops and other buildings and on the grounds themselves, while two and one-quarter millions had been devoted to the development of the water power, the erection of bridges, etc. For machinery, less than one-quarter of a million had been expended, for, as already explained, the manufactures up to that time were carried on on a very moderate basis.

Since the above date there has been laid out on building and ground improvements, on the water power development and the electric installation, and for new machine equipment nearly one and three-fourths millions—of which about one-half has been spent on the new small arms plant—this bringing the total cost to date to about eleven million dollars.

For facilities extended and for valued assistance in the preparation of these articles, my thanks are due to General Crozier, Chief of Ordnance; Colonel Blunt, Captains Thompson, Burr, Jamieson and Williams (the last two officers in charge, under the Commandant, of operations in the harness, equipment and wood-working shops); also to Messrs. Summers, Patterson and Manning.

The Ridgway Machine Tool Company's Works.

EDITORIAL CORRESPONDENCE.

The accompanying illustrations show the exceptionally fine plant of the Ridgway Machine Tool Company at Ridgway, Pa. Fig. 1 shows the entire works from a neighboring hillside, the view being from the southeast and Fig. 2 is a view from the northeast, while Fig. 3 gives a plan and several sections.

The locations of the various departments are shown in Fig. 3, as are the shipping and industrial railway tracks. The receipt of raw material is by the siding shown below the forge and pattern shop, the delivery of sand, coal and pig iron being to covered bins within the yard between the engine and boiler room and the forge shop.

The deliveries of completed machines are by the siding which enters the opposite end of the erecting floor.

The method of making deliveries to and from the machine bay and the erecting floor cranes, as well as the exceptionally complete equipment of cranes, is shown in Fig. 4, which looks down the erecting floor and across the machine bays. The completeness of the crane equipment is shown by the fact that the entire plant has fourteen of them, of which eleven of them are overhead travelers, two of them being of 40 tons, one of 30 tons, one of 25 tons, five of 10 tons, two of 5 tons, and three of 2 tons capacity. The 40-ton cranes have a span of 75 feet.

FIG. 1. VIEW OF RIDGWAY MACHINE TOOL COMPANY'S WORKS FROM THE SOUTHEAST.

The roofs of the foundry and erecting floor are higher than that of the machine floor, as is obvious from the sections and end elevation, the object being to permit the crane of the erecting floor, of which the runways are shown at *a a* and *b b*, to be placed higher than those of the machine floor, which are shown at *d d* and *e e*, and hence to permit the runways of the latter to project under the former and thus permit deliveries to be readily made either way. The deliveries from the foundry are made by a short track which runs from it across the erecting bay at the lower side of the plan and from which the erecting floor crane delivers the castings to any one of the cranes over the machine floor.

The roof is entirely of the saw-tooth construction, the pitch being equal to the width of one of the machine bays, as shown in the section *D D*. The support of the trusses which carry this portion of the roof is direct from the posts which also carry the crane runways, as shown in this section and in Fig. 6. The increased width of the erecting floor necessitates a slight modification of the construction as shown in section *C C*, a substantial truss being carried across the floor into the peak of each tooth of the roof. In the foundry the width of the floor is across the saw teeth and hence additional trusses are necessary to carry the roof, as shown in section *A A*. The result is an exceptionally high light foundry as shown in Fig. 5.

Fig. 6 shows the method of supporting the line and counter shafts for the smaller tools. The heavier ones are of course fitted with individual motors.

A feature of the erecting floor which will appeal to all is a system of three traveling jib cranes shown in Fig. 7. These cranes are supported by girders which are laid flatwise and upon which the cranes travel parallel with the wall. The trolleys rack out and in and the cranes thus give complete command of a strip next the wall equal in width to the length of the jibs. The erecting pits are below the cranes and the main crane being over them it delivers castings anywhere within their field. With three machines in process of erection at a time each erector has a crane sufficient for any ordinary piece of work for his own use, and with twice that number of erections in progress at a time, the crane facilities are obviously ample.

This view will also show that in these shops the old plan of heating with overhead steam pipes has been reverted to, and, on the occasion of a visit in the depth of winter, the result was certainly all that could be desired.

The pattern shop, Fig. 8, the smith shop, the stock room and the offices are located in the lower buildings, with timber roof, which are seen at the right in Fig. 2. The wants of the men have been well attended to. Fig. 9 shows the wash-up sinks and lockers, which former have steam connections for warming the water. Fig. 10

shows the lunch room. The company does not provide lunch facilities, but does provide this warm, comfortable room with tables and a gas heater for heating coffee. The room is also provided with an excellent list of periodicals of which the rack is included in the illustration and which the workmen are encouraged to read.

F. A. H.

American Chamber of Commerce in Paris on the Metric System.

Bulletin No. 36 of the American Chamber of Commerce in Paris deals with the metric-system question and especially reviews, very favorably, the Report of the Decimal Association of London, abstracts from which we recently published. It also contains a reprint of a "memorandum" as to the Metric System in Textiles, by Matthew Blair, yarn merchant of Glasgow, in which he strongly advocates the adoption of the system, expresses the belief that the difficulties of doing it would be inconsiderable, that its adoption offers the only hope of uniformity and regularity, and that it would be of very great benefit to the textile industries.

The Stewart Iron Company, of Pennsylvania, has been sued by the Fidelity & Casualty Company, of New York, for $4,576, on the claim that the iron company named had taken out policies with the insurance company and then made false returns of the number of employees on its payroll in order to reduce the premiums to be paid.

Legal Notes.

BY E. P. BUFFET.

A CASE IN MACHINE-SHOP APPRENTICESHIP.

Harry B—— was apprenticed to W. J. P—— to learn the machinist's trade. Aside from the regular compensation for his services, the agreement provided that at the "expiration of the second year there shall be a total apprentice reserve fund of $72 in the possession of P—— & Company in favor of the second party, subject to forefeiture in whole or in part, as herein specified." It also provided for the payment of the $72 at the expiration of the third year of faithful service. It stated further that the "party of the second part (B——) agrees on penalty of forfeiture of entire apprentice reserve . . . to remain and continue in the service of said party of the first part for the full term of three years; and if for any acts of disobedience said party of the first part shall deem it best to discharge said party of the second part, then the one-half of the apprentice reserve . . . shall be forfeited." Moreover, there was a stipulation that refusal to work the same number of hours that other men in the shop were required to do should constitute just cause for dismissal. There was a valid requirement of the employer with the employees that in cases where hurry was needed they should work overtime, such labor being paid for. B—— had frequently done the same.

Harry had been in the shop two years and ten months at the time our story begins. The tale is told by different witnesses in various versions, from which we may derive something like the following account: It was a winter's night and there was overtime erecting work to be done. A rush order had come for three tool-steel cams to be turned and bored. About 6 o'clock the foreman asked Harry to stay, with some others, and turn and bore a cam.

Harry didn't want to stay. "They took the stove down in the machine shop," says he, "and it was very cold. It was along in the winter, and it was cold, and I had been having trouble with my feet being chilled. . . . I told him [the foreman] it was cold. I didn't want to work. I had trouble with my feet. To take the job to someone nearer the stove. . . . The stove had been down three days. There was no way of keeping warm while I was at the lathe attending to my work." The foreman does not remember that Harry said anything about his chilblains.

Anyhow, it appears that the job was given to another man. When the youth showed up next morning the superintendent called him into the office. "I told him," says the latter, "that it was customary to lay the boys off a week or ten days at a time or try to get them to behave themselves, and that they seemed to come back feeling good-natured and cheerful, and they said they wished they had another week. It seemed to be a good thing for them, but that we would adopt a new plan, by setting them back thirty days; and he hesitated about going to work. I

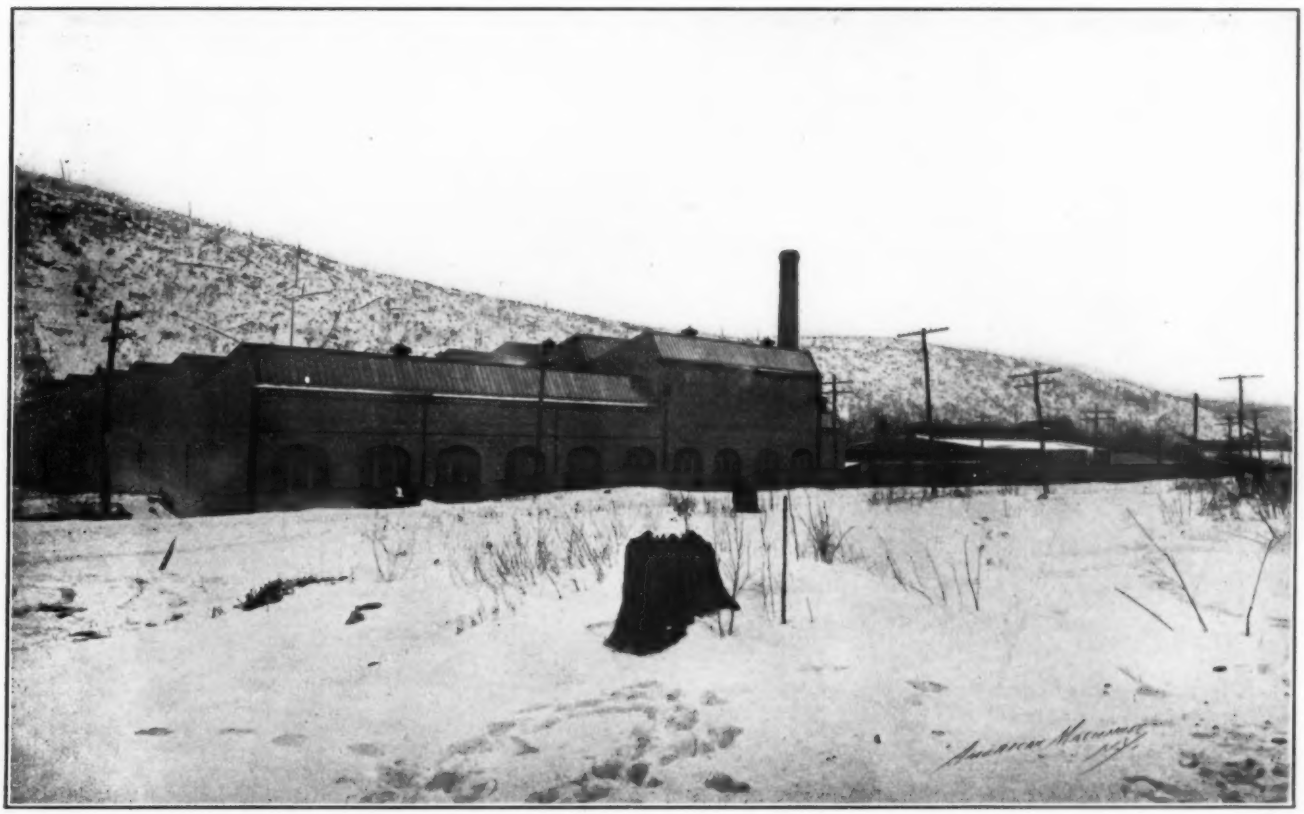


FIG. 2. VIEW FROM THE NORTHEAST.

told him he might go to work or quit; he could suit himself."

Harry suited himself and quitted. He quitted minus his reserve fund and sued his employer to obtain it. The trial judge instructed the jury that if he had been guilty of willful disobedience he could not recover, but if he had had a good excuse for not working that night and had informed the foreman, who immediately procured another man for the job, he might recover. The question was, whether the imposition of the extension of his apprenticeship term was justified. The jury rendered a verdict in Harry's favor and from judgment thereupon his employer appealed to the Michigan Supreme Court, which has affirmed the judgment.

In its opinion the appeal court answers three contentions of the defeated party. Firstly, the evidence does not, as urged, conclusively show an act of willful disobedience and it was open to the jury to decide as they did.

Secondly, it was contended that Harry had not been discharged, but was in duty bound to remain till the end of the three years. The court holds that the employer, under the contract, had no right to make the requirement of the extra thirty days, even if justified in discharging the boy. The language used amounted to a discharge with an offer of retention on terms which would have formed practically a new contract.

Thirdly, the employer cited the words of the contract, "If for any acts of disobedience of said party of the second part said party of the first part shall deem it necessary to discharge," etc. The court holds that this did not give the employer a right to pass upon what constituted an act of disobedience, but merely in the event of such an act to discharge the apprentice if he deemed necessary. Arbitrary power of the kind here sought to be enforced would have to be evidenced by very clear language.

(101 N. W. Rep., 583.)

Writing on Blueprints.

A solution of carbonate of soda or caustic soda, frequently recommended for the purpose, is not nearly so good as one of potassium oxalate. The uniform strength of solution is important, tho why a variation in the strength of such a neutral substance as potassium oxalate should make any difference I am unable to say. However, 75 grains dissolved in an ounce of water will remove the blue ground of the drawing in a few seconds; it can be applied with a pen or fine brush the solution, if necessary, being thickened with gum. The paper should be well washed afterward, for if this is not done the blue color is very likely to reappear. Engineers who use this method on large tracings frequently content themselves with mopping off the surplus solution with blotting paper and "washing" the treated part by applying wet blotting paper once or twice. This imperfect method of removing the chemicals is no doubt, responsible for the complaint made in many engineering shops that details written in this way gradually disappear from the drawing, the blue ground being gradually restored.—*Photo-American.*

For a cement for sticking leather fillet on brass patterns melt together eight parts of beeswax and two of rosin; cut into strips when cold and apply with a slicking tool of the proper radius. A steel ball of the right size stuck on a wire and heated in a bunsen burner is the best. The pattern should be slightly warmed. Superfluous cement may be removed when all is cold with a bit of waste dipped in turpentine.

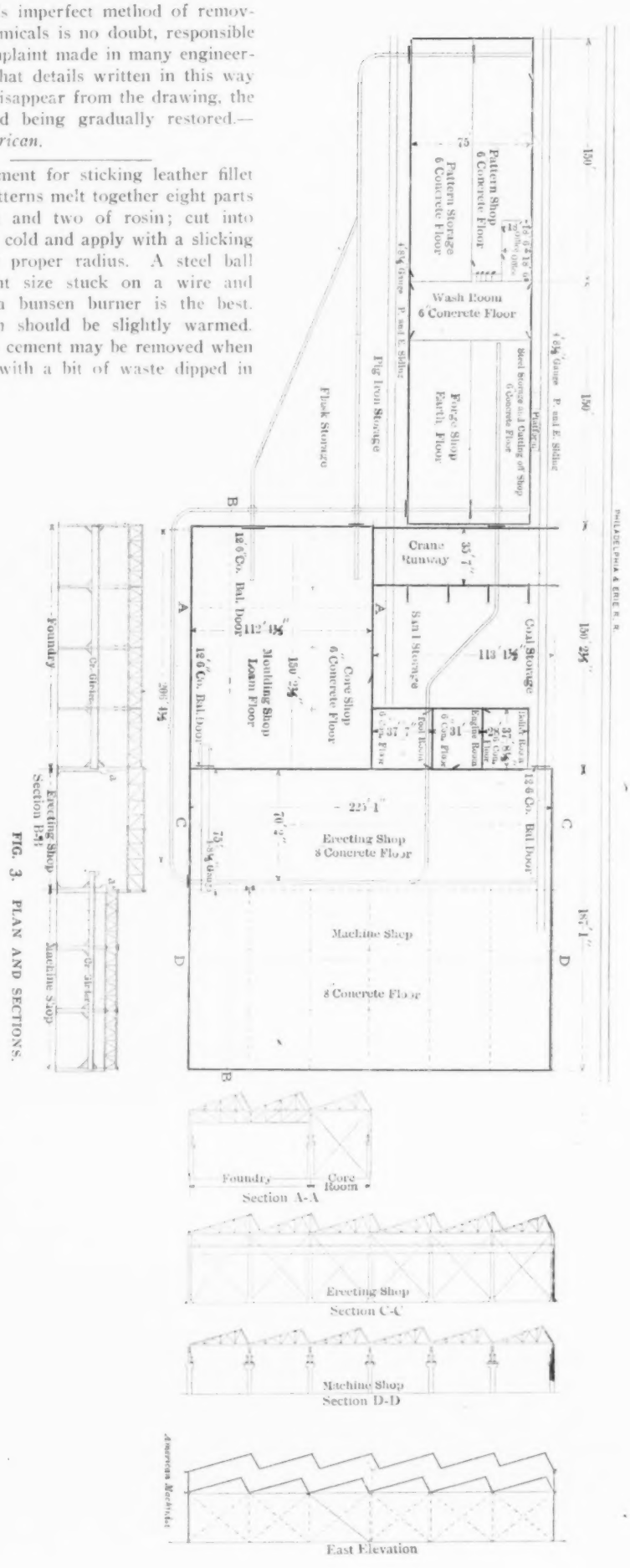


FIG. 3. PLAN AND SECTIONS.

FIG. 4. ERECTING FLOOR IN FOREGROUND, MACHINE BAYS IN BACKGROUND.

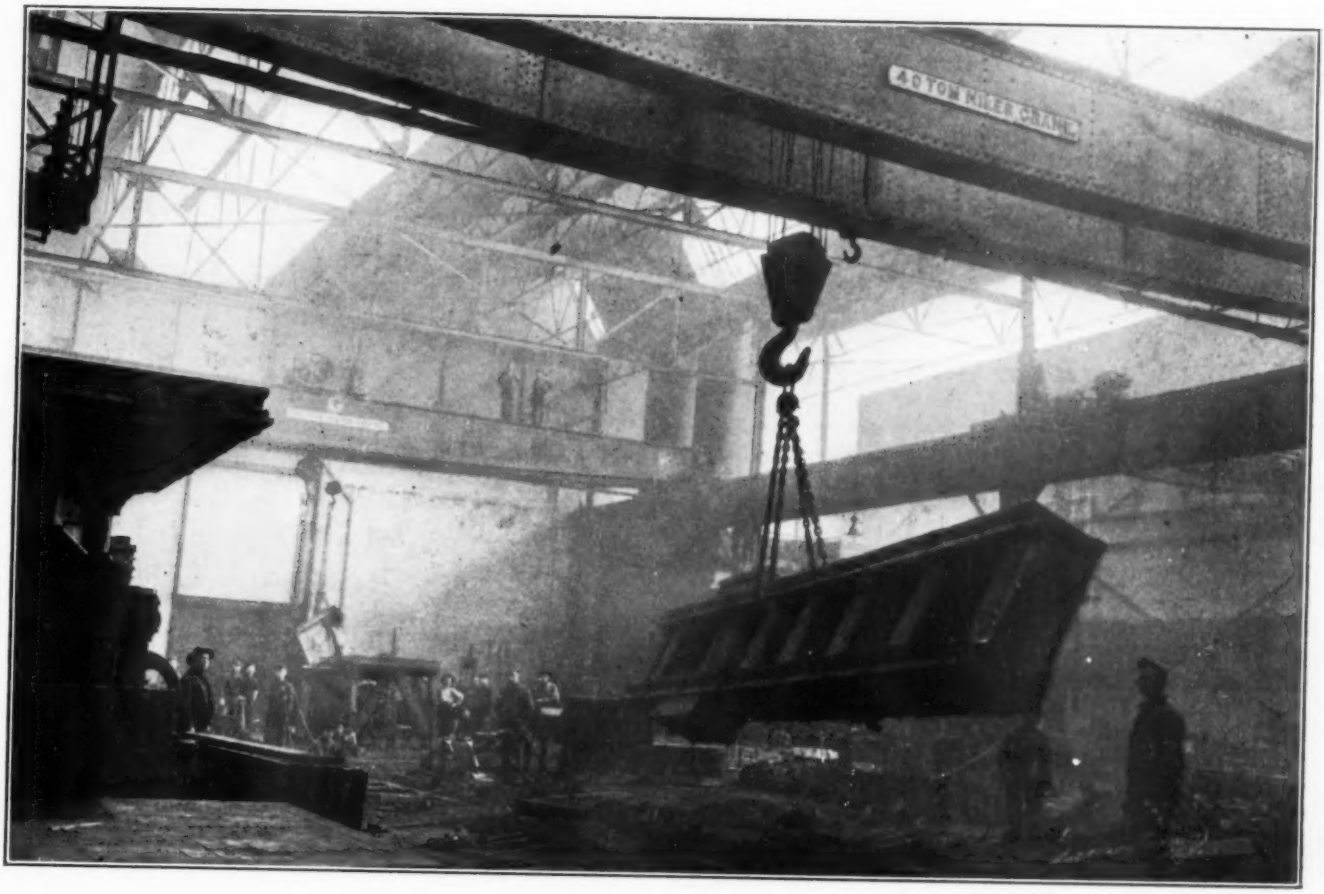


FIG. 5. INTERIOR OF FOUNDRY.

The Melting and Cooling of Foundry Iron.

R. Buchanan, president of the British Foundrymen's Association, recently delivered an address before the Coventry (England) Engineering Society in which he paid special attention to the above topic as one of great importance to the successful foundryman. An abstract of the address is here given. To produce definite and reliable results in casting iron, foundrymen must possess definite knowledge of the component irons, and in some considerable degree know what is going on from the moment the mixture is made on paper until the casting is delivered to the customer, and from him into the ranks of productive machinery.

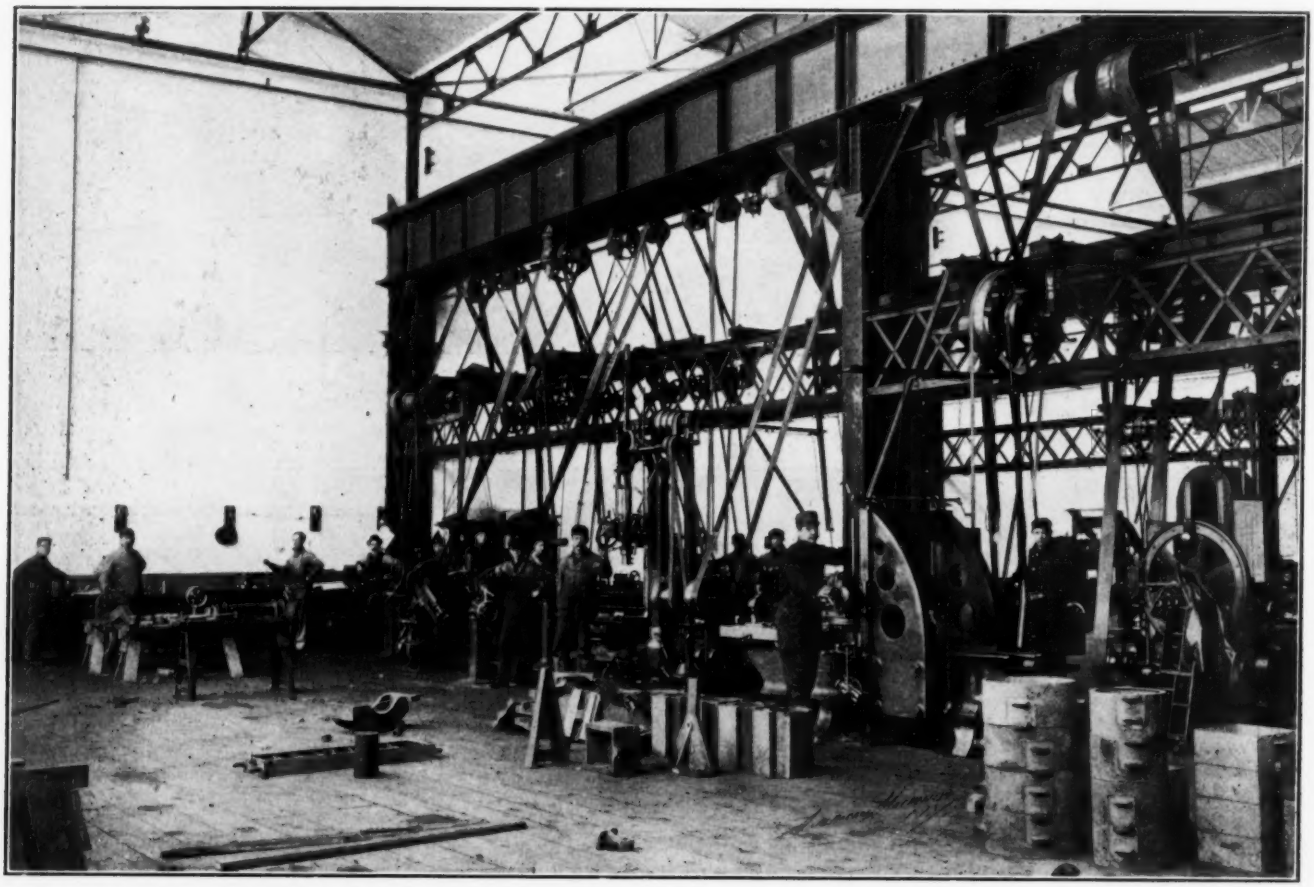


FIG. 6. SHOWING SUPPORT OF LINE AND COUNTER SHAFTS.

After briefly describing the physical process of melting in the cupola he said the sulfite of iron, the phosphide of iron, and the silicon compounds melt in the order named. As manganese and carbon are isomorphous, they probably dissolve into iron at the same temperature and at the same time. With regard to the carbon which is in the iron charged into the cupola, some of it is combined carbon dissolved in the iron and combined with it. That it should remain so is what might be expected, at least during the time the iron is in the molten state. When iron and carbon are melted together, free from the presence of other bodies, the carbon is always in the combined form, unless under very special conditions of cooling. Graphite also becomes dissolved in the iron as combined carbon, and absorbs heat in becoming dissolved. This heat is given out when graphite is expelled in cooling. All the carbon is in solution in the iron so long as it is in a molten condition. The effect of chilling is to fix the carbon dissolved in it, and some of this carbon being liberated during the pouring of a casting causes annoyance and loss in finished work. Hot iron naturally keeps dissolved an amount of gas and dissolved materials which it is unable to retain when cooler.

Many foundries cast almost all their work without feeding the castings. Strong irons always want more feeding than soft open ones. For strong, close-grained castings, iron with fairly low total carbon is required, so that no kish or carbon may crystallize and separate in the course of handling and pouring the metal. It is a debatable point whether castings for best finish should be poured as hot as the metal may be had, or whether it should be kept until cooled somewhat, tho still very much hotter than "dull" iron.

In cooling from a hot melting temperature, say 1,400 to 1,350 degrees Cent. (2,552 to 2,462 Fahr.), a fall of 50 degrees Cent. (90 Fahr.) previous to the iron being poured into the mold, consider what takes place. Any contained slag and oxide have an oportunity to rise to the surface of the metal, these being of less specific gravity than the metal. The manganese also has time and opportunity to combine with sulfur as manganese sulfide. This body, Mr. Stead says, has no hardening effect when contained in the iron. Metal at a fair casting temperature causes less erosion of the mold, tho erosion may practically be neglected when dealing with dry sand and loam molds. There is also less segregation in the casting than when the metal is hot, but that is a very doubtful advantage. A casting cast hot takes more feeding than one cast at a "fair" casting temperature. A casting cast "dull" takes less feeding still. The position of the advocates of hot and fair casting temperatures may be summarized as follows: (a) For finished castings made in dry sand or loam, and especially if test bars are attached to the casting, cast hot as the metal comes from the cupola. It probably will then conform to Longmuir's "fair casting temperature." Keep the test bars as far away from the casting as possible, to allow the bars to cool quickly. (b) When green-sand molds are for castings to be finished and machined all over, then roughness of skin is not important and the mold may be cast with hot iron. Roughness of skin is very often associated in one's mind with dirty metal under the skin, but it need not necessarily be so. In fact, much of the dirt found in finishing castings is due to excess carbon in the

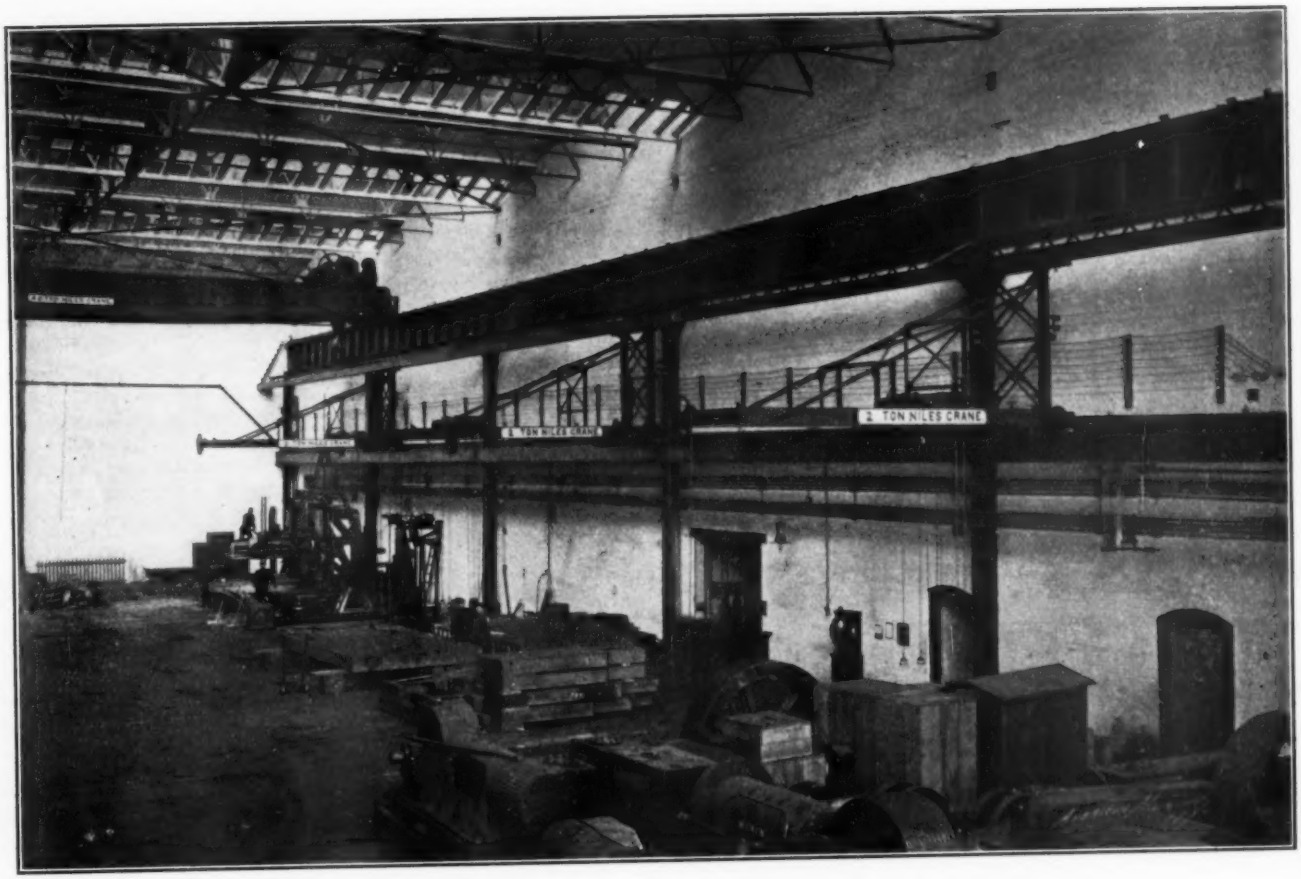


FIG. 7. ERECTING FLOOR, SHOWING TRAVELING JIB CRANES.

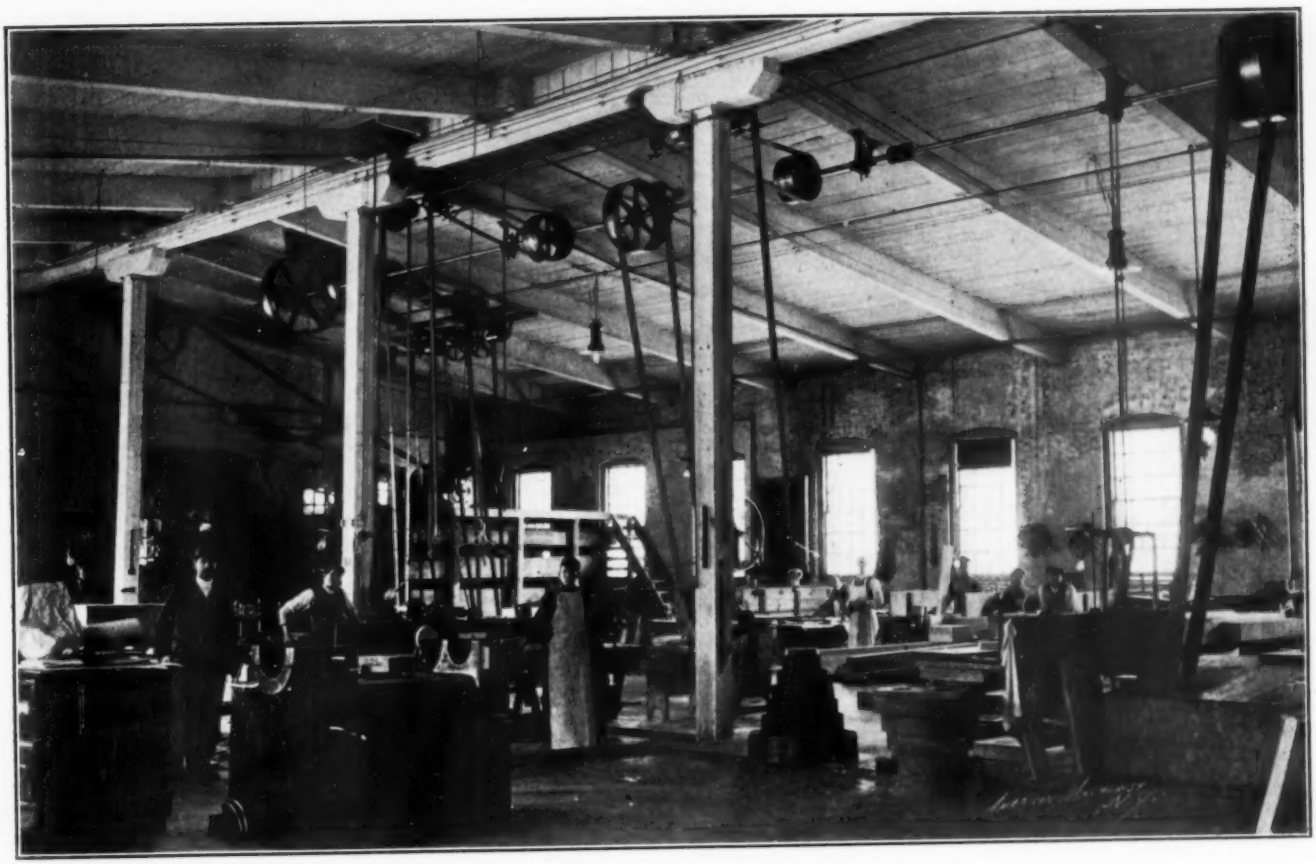


FIG. 8. PATTERN SHOP.

metal and in the molds, especially green-sand molds. (c) It is a probability that the reason why castings cast dull are weak is this: sulfide and phosphide of iron surround the crystals of iron and are in close proximity to them and remain so, owing to the rapid setting of the metal. Were the metal hot the phosphide and sulfide would segregate and so do less harm.

Dealing with the condition of molten iron in the ladle, it is easy to observe that vigorous changes are taking place. With 1 per cent. and over of phosphorous a cloud or thin skin of oxide and kish soon gathers on the top, and under this movements impossible to describe are taking place. Altho 1 per cent. of phosphorus be present, this cloud on the top of the iron does not gather if over 5 per cent. of manganese be in the iron. This percentage and over of manganese has the effect of breaking up the oxide on the top of the metal, and instead of a cloudy appearance a most beautiful series of changes of figures of an elliptic form is seen. As silicon increases the ellipses get less in size. As silicon decreases the ellipses increase in size, so molders used to working with manganiferous irons judge the hardness or softness—*i. e.*, whether low or high silicon—by the size of the ellipses or break of the metal. These ellipses are probably due to oxidation of manganese. Gray iron when melted may be considered to be a solution of carbon in iron; that is, the carbon dissolves in the iron just as salt may be dissolved in water. Manganese also is dissolved in the iron, as manganese and carbon are isomorphous; that is, they crystallize in the same way, and, indeed, combine with iron in almost exactly similar proportions. It also increases the total carbon. Silicon also is dissolved in the iron and will dissolve in all percentages, but when it reaches 4 per cent. and over it pushes out and lowers the total quantity of carbon. Silicon has a more powerful effect in lowering the total carbon than manganese has in increasing the same. Silicon probably combines with the iron in the form of silicides, such as Fe_3Si. Phosphorus is combined with the necessary percentage of iron as Fe_3P, or phosphide of iron. Most practical men have difficulty in really grasping the fact that phosphorus is present in molten iron and yet unconsumed. The phosphorus is not present as free phosphorus; if it were it would certainly be miraculous that an element so inflammable as phosphorus did not burn in molten iron. The reason it does not burn in the iron is simply that it is already in combination with iron, and so no further combination can take place. The phosphorus is combined with iron as phosphide of iron, and this phosphide is dissolved in the iron. Sulfur also is present in the form of sulfide of iron and has a most potent effect on the hardness of castings, as 0.14 per cent. makes the castings too hard to machine. No doubt the sulfide has a direct hardening effect as well as thru the carbon.

In conclusion, Mr. Buchanan dealt with the setting of gray iron, and explained that an expansion took place just about the time it solidified, in some irons immediately before solidification. It is the separation of the graphite which causes the expansion, and is a question of saturation. As Mr. Stead pointed out, this crystallization of the graphite elbows out and pushes from it the lower melting eutectic mixtures, such as the phosphide and sulfide of iron. Iron containing 2 per cent. of phosphorus when cast into a solid block, weighing 1 cwt., shows no signs of shrinkage. The supposed filling of a mold by expansion is quite erroneous. Molds are filled by fluid pressure, the runner head being the reservoir from which the pressure proceeds.

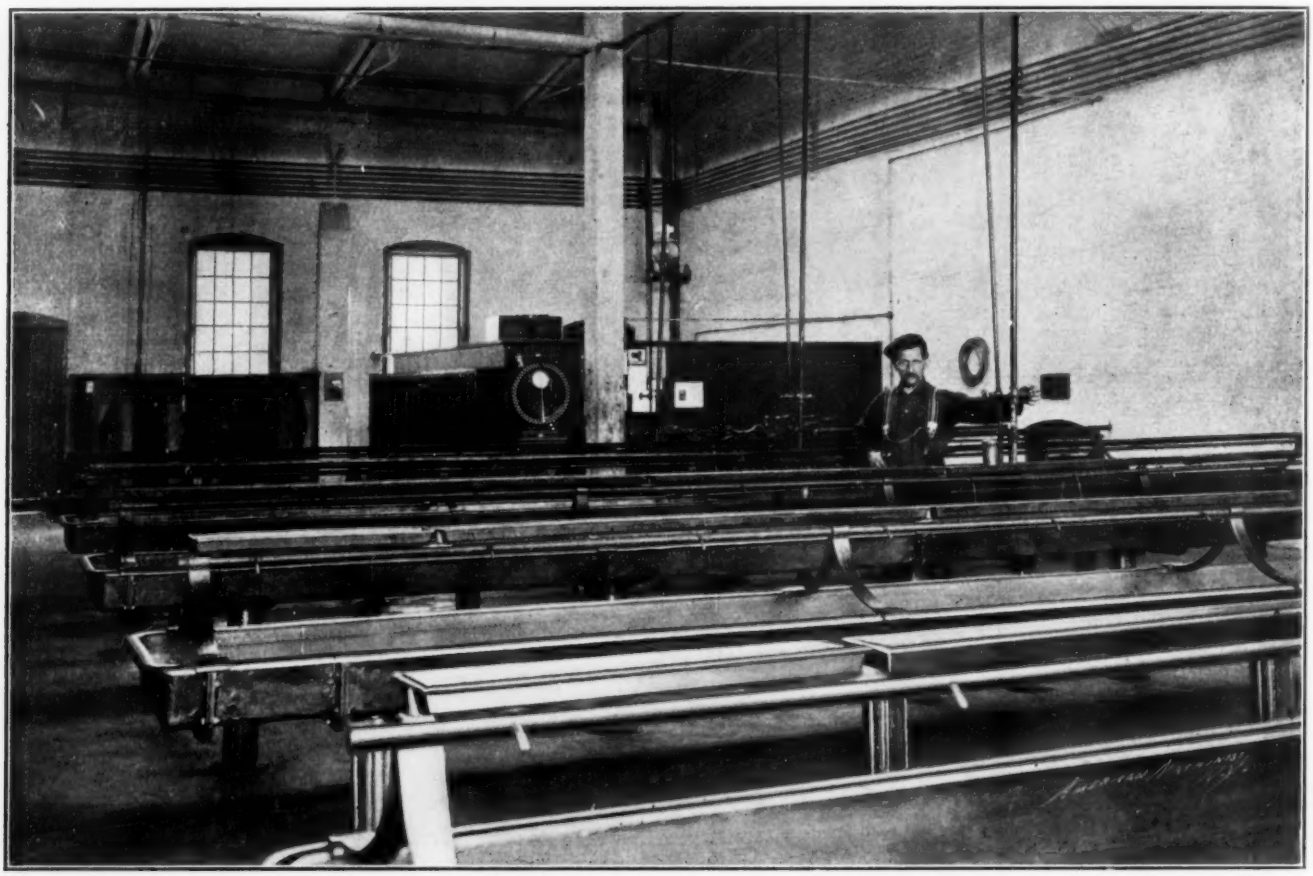


FIG. 9. WASH-SINKS AND LOCKERS.

A workman in the employ of the London & North Western Railway Works, Crewe, was recently attending a large circular saw driven by electricity. While revolving at a high speed the saw broke into pieces, one of which struck him, cutting his shoulder clean thru. His right arm was cut off, and the body badly cut. Portions of the saw pierced thru a board an inch and a half thick, and another portion was found 200 yards away.—*Mechanical Engineer*, London.

H. Le Chatelier on the Brittleness of Steel.

BY E. P. BUFFET.

The question of the brittleness of steel is one that has come to the fore in comparatively recent years and is now attracting considerable attention in Europe. The Society of Encouragement for National Industry, in conjunction with six large French railways, has brought out a book by H. Le Chatelier discussing the investigations made in that country. The introduction to the volume, giving a synopsis of the subject, is printed as an article in a late number of the society's *Bulletin*.

Brittleness, he impliedly defines as the property of breaking with little or no permanent deformation. He points out that altho it has been a well-known fact that certain metals, such as bismuth and antimony, are regularly brittle, while others, such as pure red copper, are quite the opposite, the knowledge was long obscured that there are metals, such as gray iron or steel, which are brittle intermittently—*i. e.*, according to varying conditions. Too often the results of such fragility have been attributed to flaws and local defects or to the uses to which the metal has been put when these were not the true causes. The conditions of brittleness belong to two general classes:

(1) The nature of the metal in respect to its chemical composition; its chemical constitution; its structure, determined principally by temperature of casting, mechanical treatment when hot and heat treatment; its subjection to hammering, etc.; its heterogeniety and the presence of foreign matter, such as cinders and gas bubbles.

(2) External circumstances, such as the suddenness of the stress applied; the form of the test pieces, which may have reentrant angles, may be notched or punched, etc.; and the temperature. Another condition in certain cases may be the subjection of the metal to vibratory movements while under a constant stress.

If we should express by numbers the nature or quality of the metal, the external conditions and the brittleness, we could construct a surface of three dimensions, using the first two variables as abscissas. That is to say, the brittleness is a function of these two quantities, one of which is entirely outside of it. In reality the external circumstances are complex and depend on many elementary factors. M. Le Chatelier, in his *résumé*, discusses both classes of conditions at some length. The following is a free translation of part of his remarks about the external ones:

"It is generally admitted that a sharp blow breaks a piece more readily than slow tension. The reason is that the maximum force developed during a blow increases very rapidly, so that the deformation of the metal remains small, this taking place during the entire period of elasticity. The blow permits the easy realization of a considerable stress, capable of exceeding the elastic limit of the metal, which is more difficult to attain by purely static methods, but it does not necessarily follow, as some seem inclined to believe, that the work of rupture is less in case of the impact.

"MM. Considère and André Le Chatelier have shown by impact tension tests of wires that in certain cases the work required to produce rupture decreases rapidly to nothing, as the hight of fall of the ram and consequent speed are augmented. The instantaneous elastic limit rises further and further, approximating the absolute tenacity, which remains, on the other hand, sensibly constant. And when the two stresses corresponding thereto have become identical the rupture takes place without any permanent strain—*i. e.*, with an expenditure of work insignificant as compared with slow pulling.

"The experiments of MM. Frémont and Charpy, made by impact rupture of bars resting on two supports, lead to a contrary conclusion, that usually the work required for static rupture and the work needed for rupture by impact were sensibly equal. Some metals absorbed, it is true, a lesser work in impact rupture, but they were rare exceptions, whereas in the experiments of MM. Considère and André Le Chatelier they seemed to be the rule. It

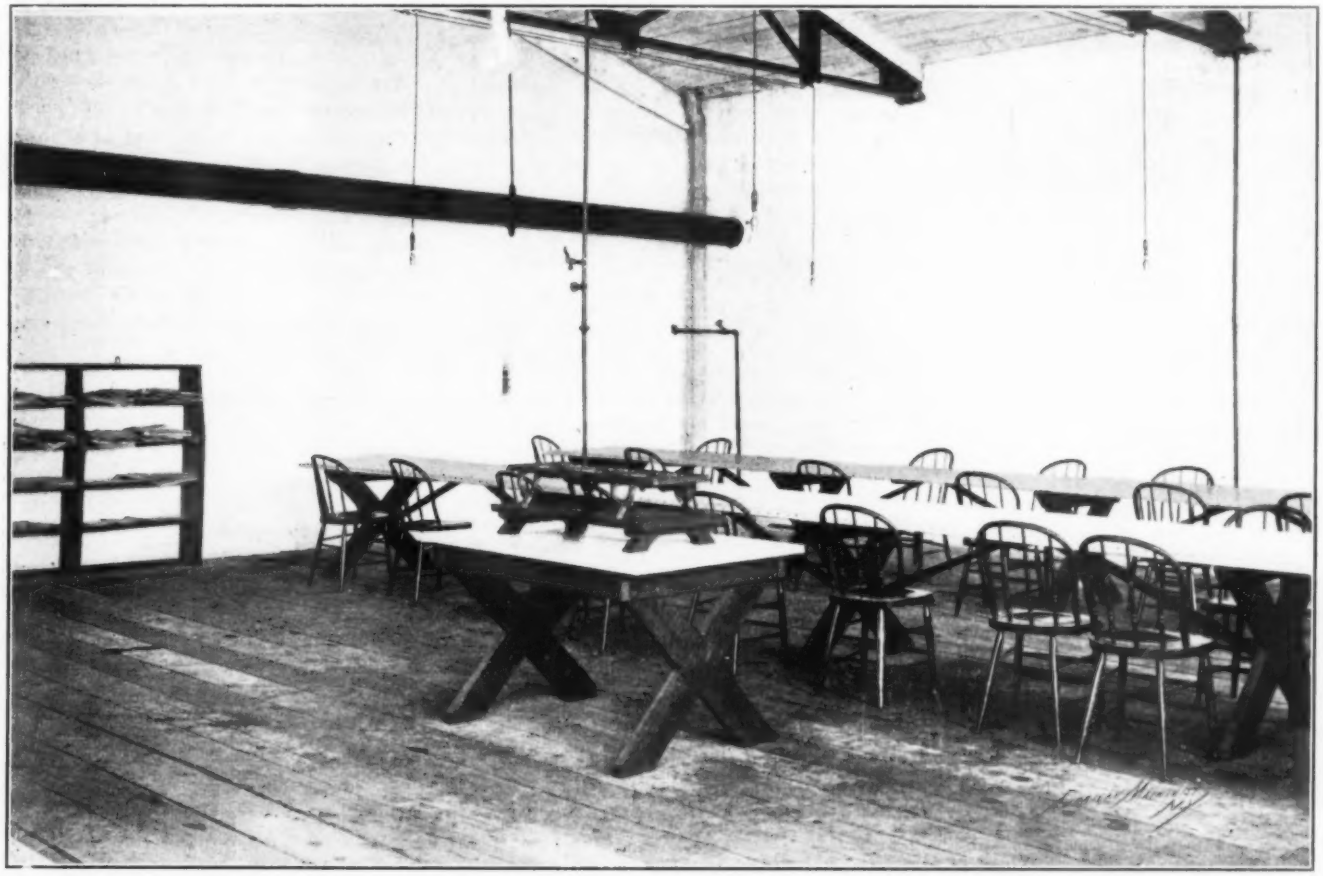


FIG. 10. LUNCH AND READING ROOM.

may be observed, however, that in breaking wires proportionate elongation, only, came into play, while in flexure of bars there is also compression.

"Finally M. de Fréminville discovered the paradoxical fact that certain special steels, after being subjected to an appropriate heat treatment, absorbed considerably more work in impact rupture produced by flexure than in static rupture.

"The speed of applying the load influences the brittleness, therefore, to a greater or less extent, but in a very irregular manner, according to the case. More often this influence is little noticed."

M. H. Le Chatelier then goes on to speak of the effect of temperature, referring to the common fact that at low temperatures iron and steel are brittle, so that it is a custom in cold weather to wash the chains of hoisting appliances with warm water to stand heavy loads. Yet it takes considerably more work to break a piece by slow traction at low than at high temperatures. M. André Le Chatelier has shown that, the lower the temperature is, the less speed in applying the load is required to break it under tension. In certain cases below the freezing point of water an application of the load in one minute is sufficiently rapid to cause rupture without deformation of the metal.

"It is a fact well known in shops," says the author also, "that when a piece of metal, such as a plate, is to be bent, it is first to be heated with some chips to a temperature not above the blue, so as to obviate breaking it when subjecting it to the change of shape. This method has the grave objection of leading to a great alteration in the quality of the metal and, as a result, making it brittle after its return to the ordinary temperature; but during the work this brittleness is not manifested, and the consumer alone has to stand the final consequences."

The ordinary property in steel or iron of being greatly affected in quality by rough treatment at a blue heat, which may be what M. Le Chatelier has here in mind, has lately been shown to admit of exception. M. Ch. Frémont has communicated to the Academy of Sciences, apparently subsequent to the writing of M. H. Le Chatelier's book, the results of some tests of boiler plate manufactured by the steel works of Denain and used for locomotive purposes by the Western Railway. He showed that after having been subjected to a permanent strain by treatment, statically or by impact, at a temperature between, say, 200 and 450 degrees Cent., their resistance to breaking was reduced only from 25 to 22. This shows that the property of undergoing great loss of strength by such treatment is not universal, and methods may be found for regularly producing metal that will not be subject to such an inconvenience.

One horse-power equals 550 foot-pounds per second.

24-Inch Back-Geared Crank Shaper.

The illustrations show a 24-inch shaper of heavy design and with powerful drive, the back gears having a ratio of 29 to 1.

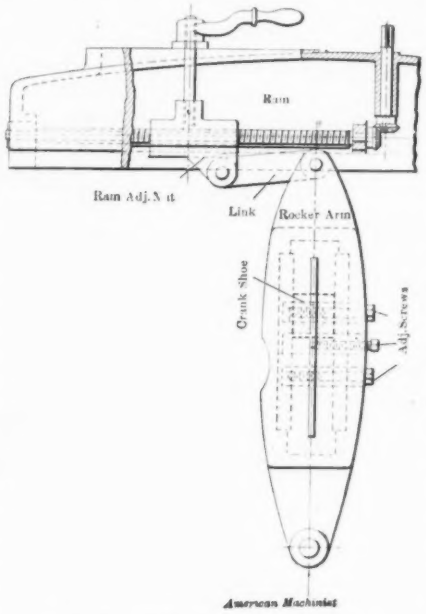


FIG. 2. RAM AND ROCKER ARM.

The column is well reinforced, and the ram, which has a 40x11-inch bearing, is arch-shaped, bringing the maximum section of metal into service when the tool is in the extreme forward position. The bearing surface on the rail is of ample breadth; and the screw, which gives a traverse of 30 inches, is fitted with a graduated dial; the feed being varied by a cam, adjustable while the machine is in motion. The rocker arm and slide are connected in the manner shown in Fig. 2, which shows also the method of adjusting for wear of the crank shoe. The driving gear, giving eight speeds, is arranged as in Fig. 3, the four-step cone pulley having an outboard support, and the gears being shifted by a lever at the rear. The rail and table (the latter is easily removed from the saddle) have a vertical movement of 15 inches, thru a telescopic screw, and the outer end of the knee is carried by an adjustable support, as represented in the half-tone. The top of the table is 27x14 inches and the side 27x17 inches. Besides the T-slide in top and sides the table has a "V" for holding shafts vertically. The opening under the ram will allow a 3¾-inch shaft to be keyseated. The vise has 14x2¼-inch jaws, opening 13 inches, and bolts solidly to the table. Both head and vise swivels are graduated; and the down-feed screw for the head, which has a movement of 7½ inches, is provided with a graduated collar. The flat bearing surfaces are scraped and gibbed; the holes in the column for the shafts are bushed. The countershaft fast and loose pulleys are 14x4¼ inches, and the speed of counter is 330 revolutions per minute. The shaper weighs 4,400 pounds, and is built by the Queen City Machine Tool Company, Cincinnati, O.

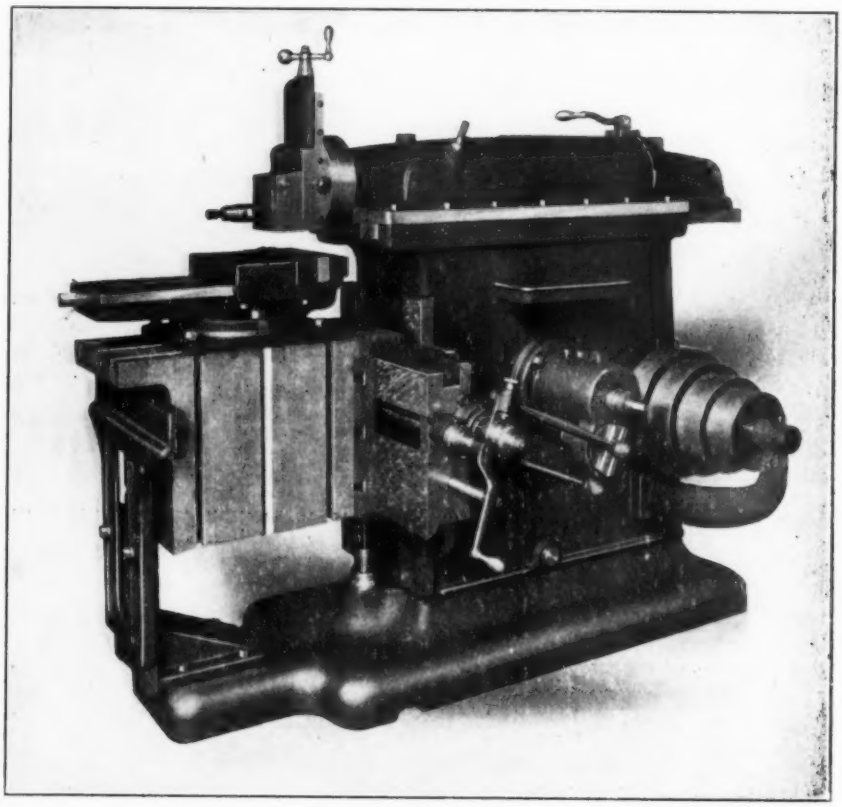


FIG. 1. 24-INCH BACK-GEARED CRANK SHAPER.

Curbs on Operating Galleries.

BY A. D. WILLIAMS.

Operating galleries are necessary on cranes and all large machines to give access to the parts requiring oiling, cleaning or other attention. On engines these platforms are usually built with gray-iron floor and stair plates supported by brackets; on cranes the brackets are of metal and the platforms are provided with hardwood floors secured by stove bolts. The railings are usually built up of pipes and fittings.

There is one serious defect in these platforms as thus usually constructed, in that while provision is made to prevent a man from falling off, no provision is made to prevent the tools and small parts laid on the platform from being accidentally kicked off and perhaps lost or damaged, to say nothing of the danger of injury to men on the floor below or to the machine itself.

It is very easy to provide a remedy for this trouble by placing a curb at least 3 inches high around all openings and around the edges of all such platforms, and a higher curb, if possible, could be used with advantage.

On existing metal platforms these curbs can be made of strip steel of suitable width, ⅛ inch thick, secured by ¼-inch tap bolts spaced six or more inches apart, according to circumstances. This metal is thin enough to allow it to be bent to suit the platform and stiff enough to stand up against a considerable blow. It would be well in many cases to make a soft iron templet to fit the platform and on this locate the holes. The curb can then be drilled from the templet and fitted to the platform, which is then marked for drilling from the curb.

On cranes the curbs can be secured to the cage framing angles. On walkways having wooden floors the strip can be bent to the shape of an angle iron and secured to the wooden floor by buttonhead bolts.

Where operating platforms or floors are made of concrete, laid either in arches or as reinforced concrete slabs, as in ammonia houses and other buildings, curbs are just as desirable. When removable slabs are used, the curb angle alone projects above the floor level; where a solid concrete floor is laid, it is usual to mold the surface up to the curb angle and avoid all sharp corners.

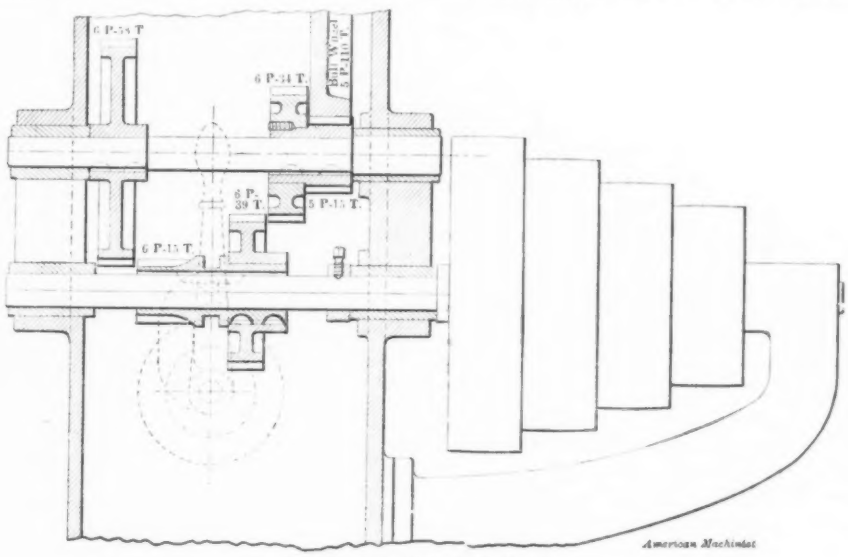


FIG. 3. DRIVING MECHANISM.

Emery Wheel Tests.

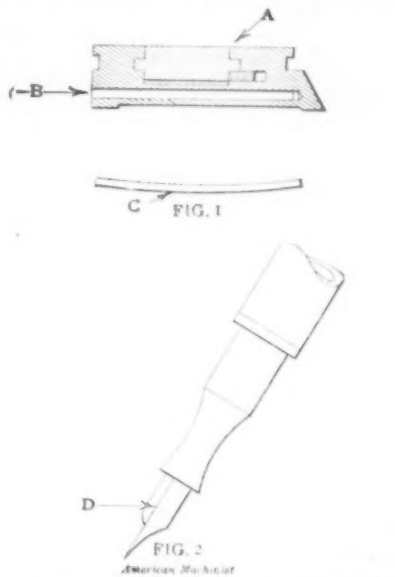
An English factory inspector, Mr. Verney, as stated by the *Zeitschrift fuer Gewerbe Hygiene*, of Vienna, has made a report on the safety of emery wheels, his attention having been called to the subject by the bursting of a wheel which had too large a center opening and too small plates to hold the fragments. He recommends the use of wheels with circular grooves on the sides to receive ring-shaped projections from the plates. With such a wheel he has made various tests. For example, a gum lac emery wheel 355 millimeters in diameter and 35 millimeters thick, rated by the manufacturer at 1,450 revolutions per minute, was subjected to a speed of 2,308 revolutions for two minutes, then to 2,526 revolutions for one minute, and finally to a speed of 2,682 revolutions for half a minute. This was as high as the transmission appliances permitted. Another, a gutta-percha emery wheel, 305 millimeters in diameter, 38 millimeters thick, and classed at 1,700 revolutions, stood for a considerable time, with a radial crack from the center opening to the circumference, a speed of 1,840 revolutions and remained entirely intact. Finally, with a wheel split the entire length of the diameter the two halves remained as closely in contact as before, after having reached a speed of 2,168 revolutions per minute.

The following were given by an English speaker as the average B. T. U. consumed per 1 horse-power per hour by steam, gas and oil engines, respectively: 13,011, 8,817 and 5,930

Letters to the Editor.

Repairing a Slide Rule—Lettering With a Fountain Pen.

Many of the readers of the AMERICAN MACHINIST have probably had some trouble with the slide in their slide-rules wearing loose (for some of the older style rules were made without a spring adjustment for the slide) and possibly there are some whose instruments have warped, leaving a crack between stock and slide.



A SLIDE-RULE REPAIR AND A FOUNTAIN PEN FOR LETTERING DRAWINGS.

Having a rule which had warped, leaving a crack about 1-64 inch wide at *A*, Fig. 1, I can say it was very difficult to read; and to make it assume its former shape and so close the gap I drilled a 3-64 inch hole, as shown at *B*, about the middle of the rule and then inserted a piano wire spring *C* whose diameter was slightly under the size of the hole.

In this manner I also repaired a rule in which the slide worked too easily. The wire should be left long until the required amount of spring is obtained to make the slide work with the necessary friction, when the wire may be cut the correct length and pushed in flush with the surface.

Every draftsman knows that to do neat work in the straight-line system of lettering, indeed in all systems, as much depends upon an even thickness of the lines which compose the letters as a proper slant for each letter. From time to time we see different methods in the AMERICAN MACHINIST for the handling of the pen to bring about the above result—*i. e.*, an unvarying thickness of the lines.

Many of the ideas I have tried with more or less success, but the fountain pen comes the nearest to perfection of anything I have used, the flow of ink is so constant and steady and the pen is ready for use at any time.

A cheap pen with the feed arranged as

in Fig. 2 answers the purpose very well. This arrangement was selected for this reason: The ink collects and dries at the joint *D*, where the feed stem touches the pen, forming a seal which prevents further evaporation; the stem being on top also holds the pen stiffer under a slight variation of pressure.

Those who have much detailing to do will find the fountain pen all that could be desired, as well as a time saver.

CYRUS TAYLOR.

The Ellipse in Isometric Projection.

There is no doubt that in many cases the use of isometric projection may be a time saver in the drawing office, especially in the matter of providing sketches for forgings, which are frequently difficult to make clear to the average smith by means of the usual three views unless a considerable amount of shading is employed. Probably the greatest barrier to the general use of this method of sketching lies in the difficulty of dealing with the ellipses which occur wherever the projection of a round object is required.

At page 1114, Vol. 22, I described a convenient method of approximating ellipses by means of arcs of circles the radii of which depend on the ratio of the major to the minor axis of the required ellipse. This was intended for general drawing purposes where the ellipse in a skew projection may have any proportions. Having recently had occasion to apply it to isometric sketching, the following short cut has been worked out:

Evidently the isometric ellipse has always one definite ratio between major and minor axes, and therefore it is possible to make two permanent scales for the radii

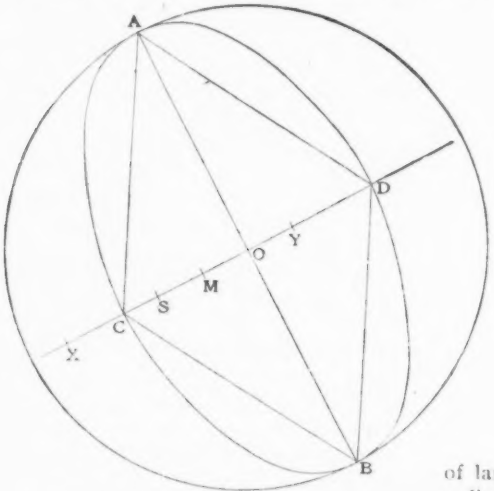


FIG. 1. THE ISOMETRIC ELLIPSE.

of the arcs used in the construction of the approximate ellipses.

If these are figured according to the radius of the circle for which they are used, it is then easy to draw in the isometric projection of any circle without any preliminary construction.

Let *A D B C*, Fig. 1, be the isometric projection of a circle in which a square has been inscribed, the diagonals *A B*, *C D*, being respectively the major and minor axes of the ellipse.

Make *D S* equal to *A O* and make *S X* equal to *S O*. Bisect *S O* at *M* and make *O Y* equal to *O M*.

X D is the radius for the larger arc, forming the sides of the ellipse. *Y D* is the radius for the smaller arc, forming the ends of the ellipse. The proof of this is given in the note previously referred to. *O A* represents the radius of the actual circle on the natural scale and may therefore be taken as a standard of comparison for other lengths.

Let $O A = 1$ unit of length.

$\therefore \quad S D = 1$ " " "

and since angle *A D O* is 60 degrees,

$$O D = \frac{1}{\sqrt{3}}.$$

$$\therefore \quad S O = 1 - \frac{1}{\sqrt{3}} \text{ and } X S = 1 - \frac{1}{\sqrt{3}}.$$

$$\therefore \quad X D = X S + S D = 1 + 1 - \frac{1}{\sqrt{3}}.$$

That is, *X D*, the radius of the larger arc = 1.4226 units of length.

$$M O = \frac{S O}{2} = O Y = \frac{1 - \frac{1}{\sqrt{3}}}{2},$$

$$O D - O Y = Y D = \frac{1}{\sqrt{3}} - \frac{1 - \frac{1}{\sqrt{3}}}{2} = \frac{\sqrt{3} - 1}{2}$$

That is, *Y D*, the radius of the smaller arc = .366 units of length.

If now scales are constructed by the well-known method of proportionate subdivision in the proportion of 1, 1.4226 and .366, as shown in Fig. 2, they will represent respectively the natural scale, the scale

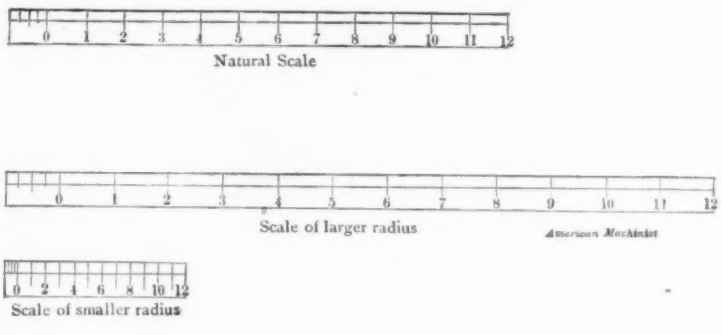

0 1 2 3 4 5 6 7 8 9 10 11 12
Natural Scale
0 1 2 3 4 5 6 7 8 9 10 11 12
Scale of larger radius
American Machinist
0 2 4 6 8 10 12
Scale of smaller radius

FIG. 2. THE SCALES.

of larger radius and the scale of smaller radius. For example, if the circle whose projection is required has a radius of 3 inches, compasses set to 3 on the larger scale will give the correct radius for the larger curve and when set to 3 on the smaller scale will give the radius required for the ends of the ellipse.

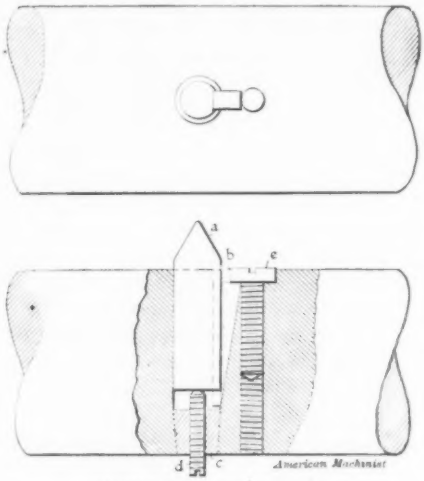
The specimen scales given in the figure are the natural scale and corresponding scales of radii suitable for sketching reduced in size. In practical use it is generally easiest to draw the major axis, then the end curves, and finally the sides of the ellipse.

F. O. HUNT.

A Boring Bar and Cutter.

Seeing from time to time sketches of different appliances used on the boring mill, and having in mind something in the bar and cutter line which has not appeared, to my knowledge, as yet, I send a sketch of it herewith.

The two views will give a fair idea of



BORING BAR AND CUTTER.

the small amount of labor required in making this form of boring bar and cutter. This construction also has the advantage of retaining a great amount of the original strength.

The cutter *a*, as will be seen, is splined to admit the feather or wedge *b*, and a rod, 3 feet long may be splined and used in lengths as required. The key *b* should have an angle of about 8 degrees, which will be ample for the wedge and yet allow it to be readily removed. A plug *c*, which is tapered slightly, is located in the taper bottom of the hole for the cutter, and in this is provided a screw *d*, which (the pitch being known) gives a somewhat convenient and a semi-accurate adjustment. Screw *e* can be any convenient pitch, with a head large enough to reach well over the key, which acts as a driver and a retainer.

J. H. A.

The Ridgway Boring Mill.

I was much interested in the new boring mill built by the Ridgway Machine Tool Company, and described at page 322—in fact, I am always interested in any new tools coming out. The description calls particular attention to some of the structural features, and, tho it is not said in so many words, one is led to think that these features are new as well as valuable. You

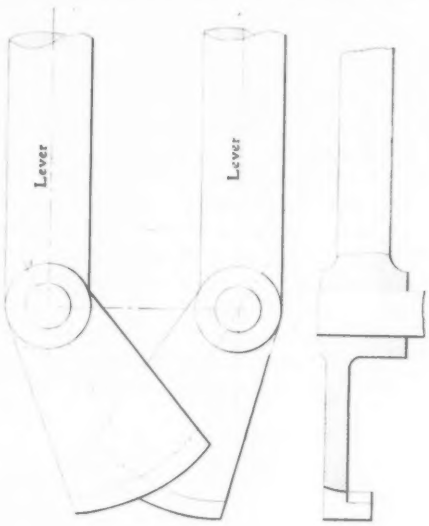


FIG. 1. INTERLOCKING LEVERS.

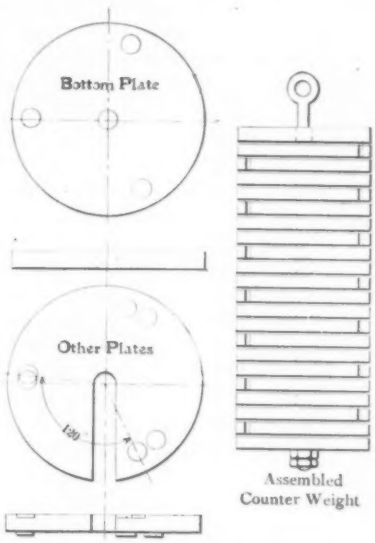


FIG. 2. INTERLOCKED COUNTERWEIGHT.

may find some mills built by the Niles Tool Works Company, at the plant of the Snow Steam Pump Works, which have the identical features. I refer to the diagonal brace in the rear, and the shelf-like top brace. Even the joint in the center of the rear brace is there. However, I do not want to lay claim to the honor of having originated this construction, as the mills were built this way at the suggestion of Mr. Bryan, superintendent of the Snow Steam Pump Works. I make this statement because I believe in giving the devil his due. Of course, I do not mean to say that Mr. Bryan—well, you know.

INTERLOCKING LEVERS.

There is another point to which special attention is called, and to which I would like to call still more special attention, and this is what is called "the extremely neat method of interlocking a pair of speed change levers." I want to say right away that I have done worse things than this myself. This consideration makes me lenient, and, if I had to sit in the jury, and the designer of the boring mill were on trial, I would be opposed to the death penalty. However, I do not want to see his crime held up to the admiration of the unsophisticated.

Such little things as interlocking devices, etc., seem big to the designer, after he has found some way of doing the trick at all; simply because they have been puzzling him. I know how it feels, for I have been there a number of times. But, after all, such devices should be worked in such a manner that they do not cost extra labor, at least if it is not possible to make them so that they actually save some. In this particular case, all that would have been necessary was to have provided each lever with a tail cast to it, the tails overlapping each other, and each tail provided with a cored notch, the notches coinciding when the levers are in their central position. Fig. 1 will show clearly what I mean. The tails may be made to hang downward, as shown; or they may be at any angle, to suit the fancy of the designer or the requirements of the case. The levers could be made reversible so as to make one pattern do for both castings and this would do away with all extra pieces or labor, and give a device just as good if not better than the one shown.

As I have said, I have committed worse crimes than the one I am condemning now, but whenever I did I always said "excuse me." The reason why I first committed the crime and then excused myself was that they would not always let me have the time to solve such little things the proper way. Of course, I want it understood that the criticism of the interlocking device is no criticism of the mill at all. I am simply taking advantage of a good opportunity to call attention to the principle which should govern the design of all auxiliary devices, such as interlocking levers, etc., namely, to construct them without spending anything except gray matter. In conclusion, I wish to show by example how it is possible to do such things.

AN INTERLOCKING COUNTERWEIGHT.

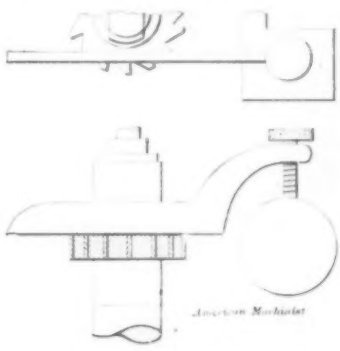
The counterweights of the boring bars for the Niles boring mills are made up of sections or plates. A rod with jamb nuts goes thru the lower plate, while all other plates are provided with slots, so that they can be slipped on or off the rod at any time. It happened once, while erecting a large mill, that the counterweight struck a cross-bar of the scaffolding while the cross-rail was being raised. The counterweight tipped over, and, all the slots of the plates being in line with each other, the whole thing came down in pieces. The boring bar, having lost its counterweight, followed suit. As luck would have it, there was a big piece of wood on the boring mill table, so that no further harm was done, but the occurrence set me thinking, and the result was that I made the counterweight sections as shown in Fig. 2. The tits, or lower projections, had always been there to provide the necessary finger room when taking the plates apart. These projections were left; but they were now unevenly spaced, and each plate was provided at its upper side with corresponding depressions, somewhat less in depth. The depressions were spaced the same way as the projections, so that the plates would fit each other in only one particular manner. The set of depressions were turned thru an angle of 120 degrees, in relation to the projections. The result of this construction was that each plate had to be turned thru an angle of 120 degrees in relation to the previous one, before it could be put in place. In this manner it became necessary to tilt the counterweight to an almost horizontal position before even one single plate would drop off, and in no case could more than one plate drop off at a time. An incidental advantage of this construction was that the assembled counterweight presented a very neat appearance.

The same object might have been reached in some other way (and perhaps by a more "striking construction"), but I believe it to be difficult to find any way which costs less and does it better.

A. L. De Leeuw.

A Simple Gage for Setting Cutters for Splining.

The sketch shows a tool used in centering a milling cutter for splining drill-press spindles and feed rods. After failing several times to spline spindles central by the old method of raising the work up to the cutter until both edges of the cutter break thru the round surface of the spindle at the same time, I decided to make this tool for the job.



SIMPLE CUTTER SETTING GAGE.

It consists of a piece of steel milled into the shape shown with a drilled and tapped hole in the curved end, for a ¼-inch

thumb-screw 1¼ inches long, with nurled head about 1 inch diameter. The edge shown near the cutter should be perfectly straight. With this edge against the cutter bring the screw up to the work. Now, without moving the screw, place the straight edge of the tool against the other side of the cutter, and if the screw comes in contact with the work on that side also, the cutter is central with the work.

LUCIEN B. GUNN.

The Test Indicator Used as a Comparator.

As the test indicator is now a recognized shop tool, I feel that an explanation and photographs of one of a number made by me some years ago may be of interest.

While my instrument answers, I believe, all the purposes of a test indicator, and is as convenient and accurate for this purpose as any I have yet seen, it was really

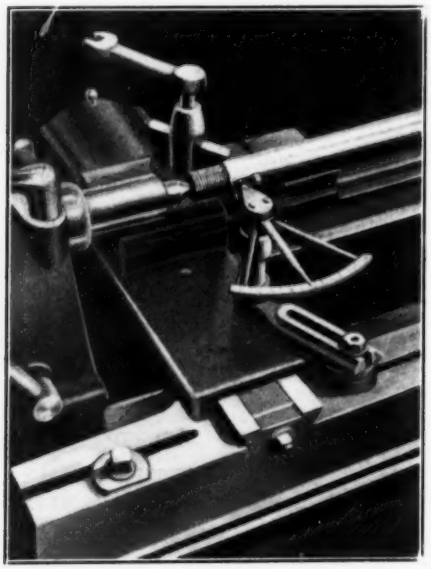


FIG. 1. THE COMPARATOR IN USE.

designed for a measuring machine (within very small limits) and was consequently called a "comparator." As will be seen upon investigation, its capacity for measuring is only approximate, but it will compare one piece with another with the greatest accuracy, which, after all, is what we do when measuring, whatever the instrument used may be.

Fig. 1 shows the instrument in a lathe measuring the diameter of pieces being turned or comparing these pieces with a predetermined standard.

Fig. 2 shows the instrument with the dust cover removed, disclosing the working parts. It will be seen that the instrument consists of a base *A* slotted out to admit of a bolt for fixing to the table or part of a lathe or other machine. A vertical tube *B* fixed to one end of this base *A* and threaded and slotted at its upper end and fitted with a nurled clamping nut *C*. A spindle is fixed to the upper part of the instrument, which is a sliding fit in the bore of the tube *B*, in which it can be adjusted vertically and around a radius and fixed in any desired position by the clamping nut *C*. *E* is a sector-shaped frame carrying the moving parts of the instrument and graduated at its perifery to read approximately to thousandths of an inch. *F* is a small gear quadrant pivoted on pin *G* and fitted with a roller *H* at one end, having gear teeth at the other, which in turn engage with the teeth of pinion *I*, which is fixed to the aluminum pointer *J*. A small spiral spring keeps the pointer always in one direction and provides against back lash or lost motion in the working parts. *L* is a stop pin over which the pointer is sprung when it is desired to keep the roller away from the work.

The method of using as at Fig. 1 is to bolt the instrument to the carriage of the lathe at the back, sliding it forward by use of the slot in the foot, and raising or lowering to bring the roller about on the center line; it is then pressed up against the work until the pointer is forced away from its stop; either the master piece is then put on the centers or a first piece is turned to the exact size required and very carefully measured with a micrometer; the reading of the comparator is then noted and any number of additional pieces may then be turned to this exact size without further measuring or indeed even stopping the lathe except to take one piece out and place another in the centers, as the comparator does its measuring while the work is rotating, and as the roller only is in contact also, there is little friction and the degree of accuracy attained is extremely high; the personal element, so great in the use of a micrometer, is also eliminated.

In Fig. 2 it will be seen that the angle piece carrying the roller is removed and that the roller is placed direct on the quadrant arm and can be used to bear on the rear side of a piece being faced to thickness; when used in this way, allowance must be made for the wear of the cutting tool; consequently the pieces must be measured occasionally—say every third or sixth piece faced, when, if it is found that the tool is worn any amount, the next piece will be faced to a reading an equal amount greater, the measuring of the difference required being done by the comparator and for which the graduations are sufficiently accurate. Altho allowance has to be made in this operation for the wear of the tool, it is the one in which the usefulness of the comparator is most fully brought out, as anyone who has had to face small pieces to a considerable degree of accuracy will readily understand. In work of this sort, the finishing cut should be taken outward or from the center, so that it is impossible to get a micrometer upon it until the cut has been finished, but even if this is reversed and the cut taken inward it is undesirable to stop the cut for measuring, as it always leaves a mark and the piece when measured in either way is nearly always found to be either too large or too small; if the former, it is spoiled, and if the latter, another cut must be taken. I have found by actual experience that to face pieces of this sort to within .0005 inch limits requires an average of four very light cuts because of the impossibility of judging the depth of such small cuts, whereas with the comparator the carriage is brought to a position in which the pointer indicates the size and the cut taken at once and without any question as to its accuracy. It will be observed here that it makes no difference what position the piece to be faced takes when driven or forced upon the mandrel, as it is simply a question of the distance between the cutting tool and the roller of the comparator which gives the size.

When the instrument is used for measuring thicknesses from a face-plate, it will be readily understood that no allowance for wear of the emery wheel or tool is necessary, as in this case the relative positions of the face-plate and the roller are fixed, and any number of pieces may be

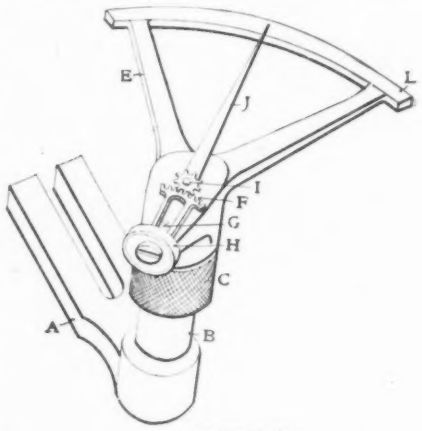


FIG. 2. COMPARATOR WITH DUST COVER REMOVED.

ground or turned without hesitation and with great rapidity, simply bringing the wheel or tool up and removing the stock until the pointer indicates the correct predetermined size. In this class of work to measure one piece out of every twenty finished is quite sufficient, and it is in no case necessary to stop the machine and measure, as a piece just removed may be measured while the next one is being ground or turned.

The examples I have given show that its adaptability for measuring or comparing is practically unlimited and that it can be usefully applied to almost any machine tool for measuring any piece of work of which there are any number to be made exactly alike; it reduces the time required to do *accurate* work enormously, because no time is lost in stopping to measure, and also that the full amount to be removed is done at once with certainty. The accuracy attained for the reasons given above is very fine and exceeds greatly that which it is possible to obtain with a micrometer. You will also see that the features which

make it so perfect for the purpose of measuring or comparing also make it extremely convenient and applicable for testing purposes. The wear in this instrument by years is almost imperceptible, and what little does take place is so well taken care of by the pressure being always in one direction that its accuracy is quite unimpaired. The tools have to be made very nicely, but in practise have been found to be suitable for every-day hard work and to possess an extraordinary long life of usefulness.

H. E. BROWN.

England.

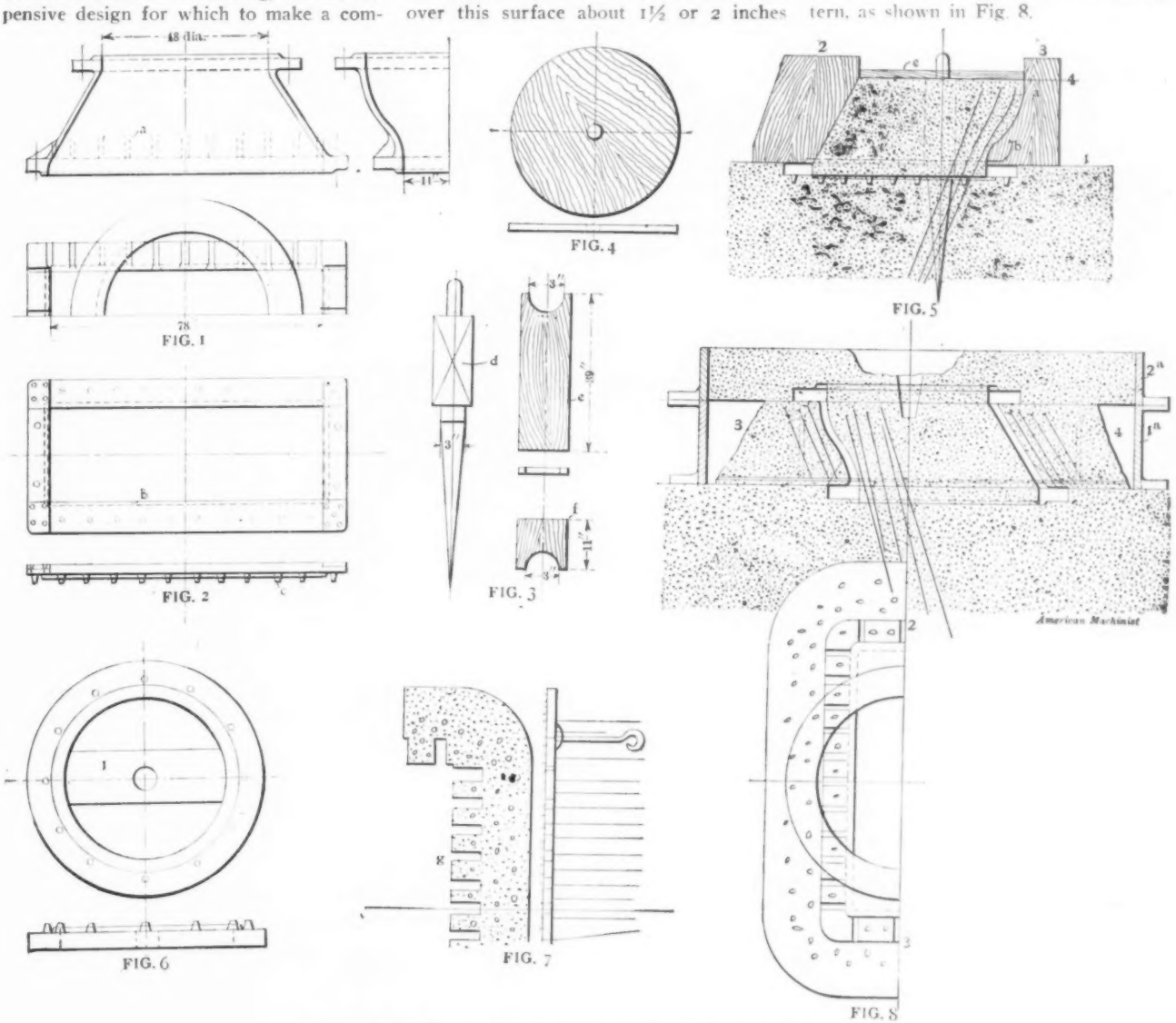
A Special Casting Without a Pattern.

Fig. 1 is a sketch of a casting of a rather awkward section for molding, and an expensive design for which to make a complete pattern where only one casting is required. The method employed in molding it proved entirely successful and may be of interest.

The rectangular flange pattern, Fig. 2, was made with half-lap joints secured by screws, as shown, and mounted with facing strips *b* and core prints *c*. This is first bedded in the foundry floor to a true level and the wooden center pin *d*, Fig. 3, is fixed in a central position, being located by the centering pieces *e* and *f*. This pin is rammed secure in a perfectly vertical position and joint 1, Fig. 5, is stroked off. The wooden disk *c*, Fig. 4, 48 inches diameter, now takes its position on the center pin *d*. Sand is packed on all sides of the center pin, as shown in Fig. 5, and formed to the internal section or contour of the desired casting by the aid of wooden strickles or strokers 2 and 3, Fig. 5. The sand overhanging at point *a* is supported by iron rods as shown to the right of Fig. 5, driven about 24 inches into the foundry floor. A coating of parting sand is now tooled over the sand core thus formed on all sides, cut nails or sprigs are placed all over this surface about 1½ or 2 inches apart, the heads being left protruding to a length corresponding to the required thickness of metal, ⅞ inch. Pieces *b*, Fig. 5, of an indefinite thickness and ⅞ inch wide are now sprigged on to the rectangular flange pattern. These form a guide for the strokers which correspond to the outside profile of the casting and similar in every other respect to those already referred to. After these are used and sand is packed on all sides of the core, the wooden disk, Fig. 4, is taken away and a coating of parting sand is tooled over the sand thus formed, at the same time covering joints 1 and 4, Fig. 5. At this stage the patterns for brackets *d*, Fig. 1, are fixed to their respective places previously marked on the flange and are temporarily sprigged in position.

Loam in a semi-dried state is now laid on joint 1, Fig. 5, to a thickness of about ¼ inch, and gray-iron drawback plate *g*, Fig. 7, is placed on both sides, the bottom face of the plate having small projections cast on to carry this loam. Wrought-iron spikes, which are cast perpendicular in the plate, are now bent to follow the sand pattern, as shown in Fig. 8.

After this is done a central vertical parting plate ⅛ inch thick is fixed at the joint and temporarily held in position. Sand is now rammed on the draw plate and against the sand pattern, as shown in elevation at points 3 and 4, Fig. 8, up to joint 5. The parting plate is now taken away and faces 2 and 3 are covered over with parting sand. Drawback plate No. 2, similar in every re-



MOLDING A SPECIAL CASTING WITHOUT A PATTERN.

spect to the one already referred to, is fixed on the opposite side. We now proceed along the same lines as before until joint 5 is arrived at. A parting is now formed on the outside faces, as shown at points 3 and 4, Fig. 8, and the flange pattern, Fig. 6, is fixed on the center pin and located by the hole in the cross piece. Box-part 1 *a*, Fig. 8, is now staked in position and temporarily rammed to joint 5 to receive box-part 2 *a*, Fig. 8. This is now rammed and runners, risers, etc., are fixed in position, after which it is taken apart, the flange pattern is withdrawn and the mold tooled and finished.

Box-part 1 *a* is now taken away and all sand cleared, also the drawback plates are removed, the parting being at joint 2 and 3, Fig. 8, as already referred to; these are tooled, finished and dried in the foundry stove. The sand forming the outside body is removed and the flange pattern is withdrawn. The bolt-hole cores are fixed in the respective prints and this part of the mold is blackened and finished. When sufficiently dried the drawback plates are fixed back in their former positions, also box-part 1 *a*, which is again rammed with sand to receive box-part 2. The mold is now closed and secured. This casting was made in an exceptionally short time and gave satisfaction to all concerned.

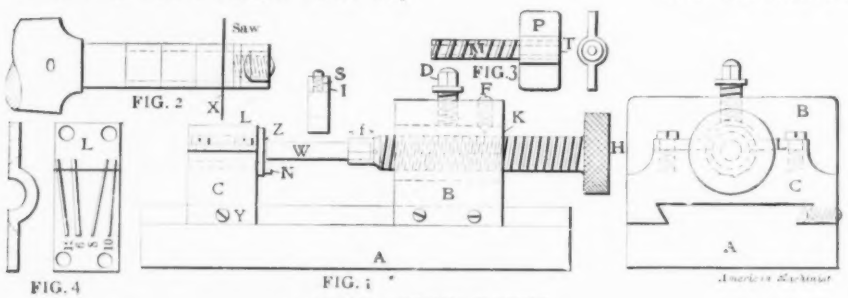
Brymbo, N. Wales. ROBERT JONES.

A Spring Winding Fixture.

Noting at page 1428, Vol. 27, "What a Circular Saw Can Do," and Mr. Schoenherr's account, at page 1742 of the same volume, of the sawing of helical grooves in brass bushings, it occurs to me to tell of still another circular-saw job.

I was once with a concern where they used a great many long spiral, or, rather, helical, springs, and as the shop had no special machinery for winding them, I designed what we called a leader, and the fixture for making it. This fixture was made with a gray-iron base *A*, Fig. 1, and two movable heads *C* and *B*, which were bored out in line with each other. *B* was bushed with a threaded bushing *K* to receive screw *H*. Screw *F* held *K* in place. *K* was split so that screw *D* could be made to bind *H* sufficiently to control the "back kick" of saw *X* as the work *W* entered bushing *Z* and the saw began to cut. Saw *X* was mounted on milling arbor *O*, as shown. The end of *H* was bored and split and turned on the outside at *f* for collar *I*, which held work *W* by binding with set-screw *S*.

The job was "set up" by placing *A* in the milling machine vise, setting the vise over to an angle parallel with the thread of the screw *H* and taking a drop cut thru cap *L* into bushing *Z*. These slots 6, 8, 10, 12, Fig. 4, act as guides for the saw when cutting work *W*, Fig. 1. We had a great many springs of different pitches to wind, so the fixture was designed to mill all the leaders for the different pitches, by simply changing bushing *K* and screw *H*. Cap *L* and bushing (which, by the way, was held from turning by small screw *N*) were replaced by another cap and bushing if the angles of slots 6, 8, 10 and 12 neither of them matched the screw *H* then in use. Either right- or left-hand threads can of course be milled, as shown in Fig. 4. In Fig. 3 *M* is the finished leader, and *P* is a thumb nut driven on it to turn it by.

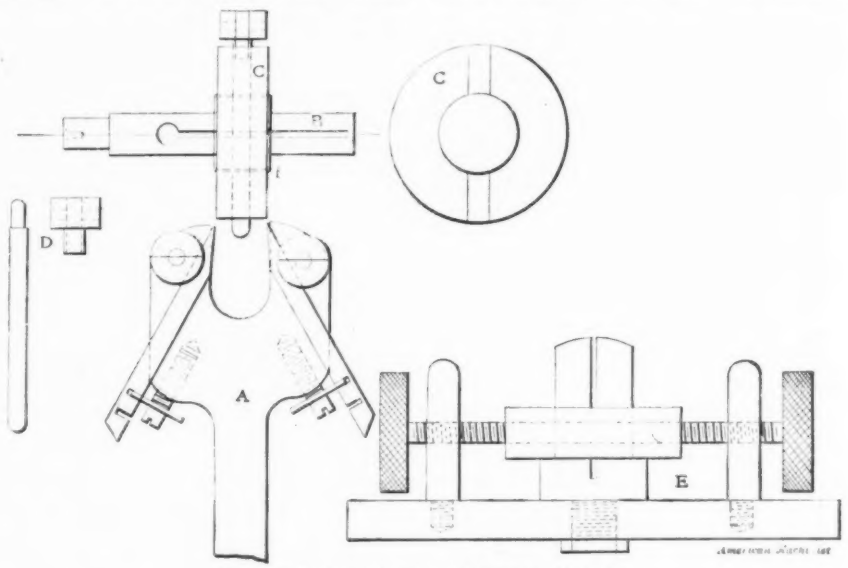


A SPRING WINDING FIXTURE.

The hole *T*, Fig. 3, is a running fit on a 3-foot piece of drill rod of the right size for inside of the spring wanted. A clamping device was mounted on a small spindle on the bench, which held the rod and wire firmly together; then the leader was slipped on the rod close up to the clamping chuck, a few turns of the wire were laid into the grooves or threads of the leader, then the power was started, and the wire was wound into a spring 3 feet long and cut up afterward into short lengths as needed. E. W. NORTON.

Tools for Facing and Splitting Brass Collars.

The sketch herewith shows a set of tools for facing and splitting brass collars. It is necessary that they should be uniform in width and the faces about equidistant from the hole already drilled. *A* is the facing tool with adjustable cutters, and *B* a split arbor with the collar *C* in position for facing. The arbor is made so the collar will slip off and on freely, and when the center is forced in at the split end it will expand the arbor sufficiently, as the pin and cap *D* will hold the collar in position when facing. The pin has to be a nice fit in the arbor as well as in the collar; if not, there will be a variation in the width, as it will allow the collar to run out. To overcome any slight change in the holes, taper the pin a little at the end which receives the cap. The cap must be a nice fit on the end of the pin, also in the collar, as it is one of the main features in keeping the collar central on the arbor. Two holes are drilled in the cap in order to use a piece of drill rod to remove it easily.



TOOLS FOR FACING AND SPLITTING COLLARS.

The milling fixture for cutting the collars in half is shown at *E*. The ends of the screws are tapered just enough to take up any slight variation that may occur in drilling.

I cannot recall the time it would take a man to work up a hundred of these collars, but at present a boy is operating the tools and the results are surprising.

JOHN KNOUSS.

A "mill power," a unit used to rate water power for renting, is in Holyoke, Lowell and Lawrence, Mass., and Manchester, N. H., equivalent to a flow of water that would give about 86 horse-power. At Minneapolis it is equivalent to 75 horse-power, while at Cohoes, N. Y., it is only equal to 13.6 horse-power. A little standardizing here would seem to be appropriate.

Double Head Axle Lathe.

The illustration, Fig. 1, shows an axle lathe of new design. It is driven by a single pulley having a constant speed. Three cutting speeds are obtainable thru a speed variator, Fig. 2.

The power is applied to the pulley *F* which drives the shaft *G*, on which is keyed the pinion *B*. This pinion drives the gear *C*, which, together with *D* and *E*, is keyed to a brass-lined sleeve running loose on the shaft *H*.

The change of speed is accomplished by engaging *C*, *D* or *E* with the gear *A*, which is shifted laterally on the shaft *K* by means of the lever *L*, thru the shifter *P*.

The method of changing is as follows. Pull the knob *N*, which operates the case *M*, back. Shift the lever *L* to the required position—the speeds being indicated by figures—then push the knob *N* forward as far as it will go and drop in the notch. This is a positive lock, which prevents the gear *A* from being shifted until the knob *N* is pulled back, and also prevents the knob *N* from being thrown in until the gear *A* is in the correct position.

The gearing is of steel and runs in an oil-tight casing. Changes of speed are accomplished thru conveniently located levers. There are four changes of feed instantaneously obtainable, ranging from 1-16 to 3-16 inch per turn of the axle. The driving head situated between the two carriages has an opening 10 inches in diameter thru which the axle is passed. The head is provided with a double self-centering driver. The two brass-lined bearings of the driving head are 5 inches long by 13 inches diameter; between them the driving gear is mounted. The axle running on dead centers is finished at both ends without reversing. The tailstock spindles are 3 7-16 inches diameter. The lathe swings 19½ inches over the ways and 8 inches over the carriages. It takes 7 feet 8 inches between centers. It is built by Charles Bridgeford, Rochester, N. Y.

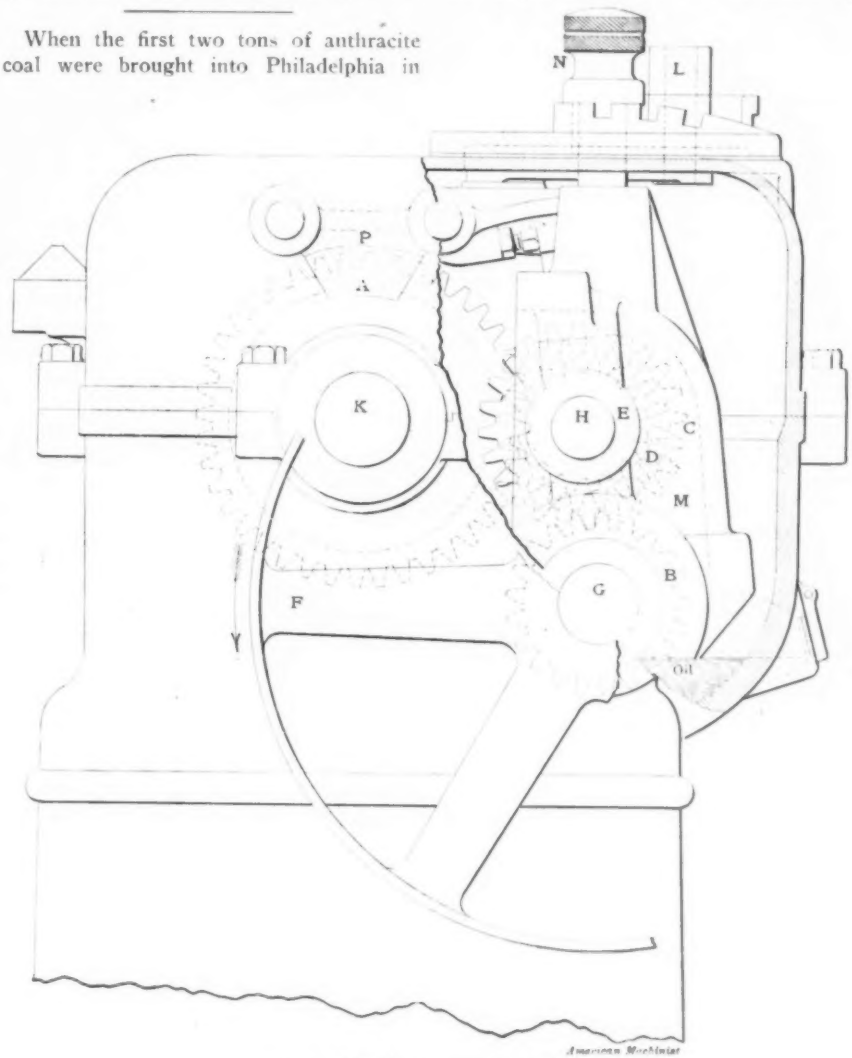


FIG. 2. DETAIL OF SPEED VARIATOR.

When the first two tons of anthracite coal were brought into Philadelphia in 1803, the good people of that city, so the records state, "tried to burn the stuff, but at length, disgusted, they broke it up and made a walk of it." Fourteen years later Colonel George Shoemaker sold eight or ten wagon loads of it in the same city, but warrants were soon issued for his arrest for taking money under false pretenses.—*Coal Trade Bulletin.*

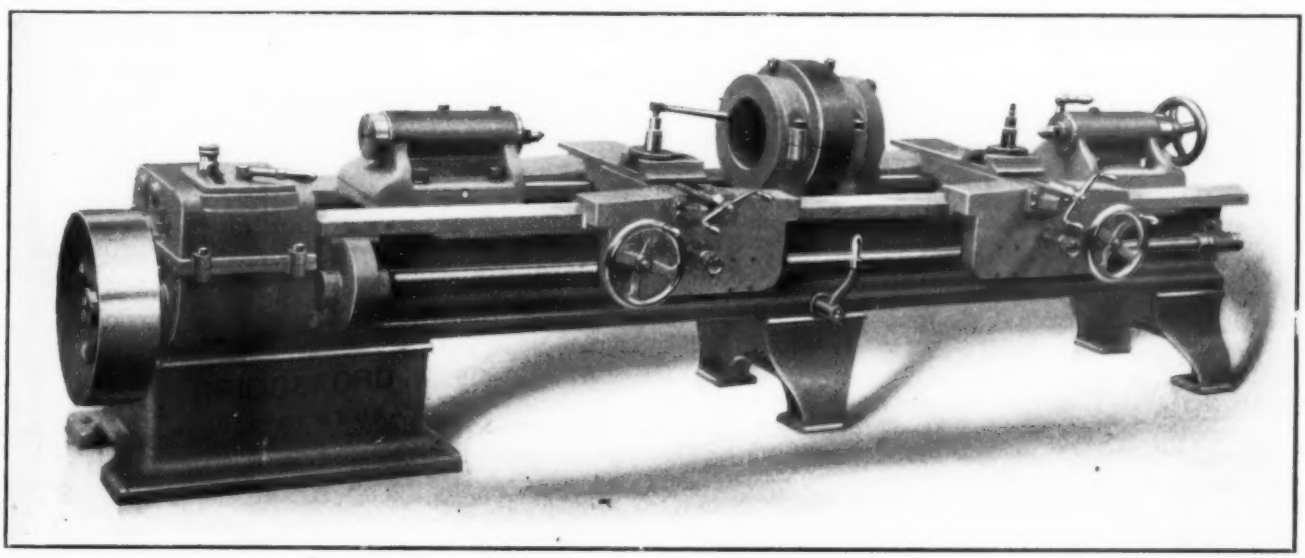


FIG. 1. DOUBLE HEAD AXLE LATHE.

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Suits for Infringement.

We have recently been receiving an unusual number of circular letters asking us to notify our readers that the firm of "A. B. & Company" or some other has brought suit against the firm of "X. Y. & Company" or some other, for infringement, and that all users of the devices made by the X. Y. firm, etc., will be "prosecuted to the extent of the law." Our readers may have noticed that this is a feature which is absent from the columns of the AMERICAN MACHINIST. Some of our contemporaries publish such things apparently for no other reason than that a manufacturer has asked them to do it and quite often it occurs that in a subsequent issue they publish a contradiction or a modification of the article because the other side having been heard from, the case looks different. Long ago the AMERICAN MACHINIST discovered that there is no telling when a lawsuit is ended, and that until it is ended and one side or the other has given up the fight, there is no telling what effect, if any, decisions of the courts will have upon the business concerned.

In many cases of these notices which are sent broadcast to the effect that suit has been brought, etc., we are convinced that they are little or no better than blackmail. They are simply attempts to prevent competitors from doing business, and we believe that in most cases purchasers of machinery should pay very little attention to them, especially when assured by the vendor, a responsible party, that no harm will come of the suit, and that purchasers will be protected. The fact that suit has been brought signifies in these days little or nothing, and the only significant thing is the final last decision of the highest court, or a decision of a court which both parties accept as final. If a manufacturer wishes to use his advertising space for announcements to the effect that he has brought suit, etc., he of course has the privilege of doing it; but no litigant can use the reading columns of the AMERICAN MACHINIST for publishing notices of that kind, the effect of which is to injure more or less the business of a competitor before the case has come to trial, and without reference to the fact that the final decision of the court may be in favor of the defendant, or, in other words, that there has been no infringement and that therefore the person sued has had a perfect right to make and sell the article in question. Of course it is quite natural and to be expected that litigants should be partisans and that each should be sure of the justice and confident of the ultimate triumph of his own side; but this confidence does not justify an impartial journal in publishing articles calculated to injure a person not legally adjudged guilty of infringement.

Those of our readers who are interested in the finishing of duplicate pieces in the lathe or grinder should not miss the letter published elsewhere in this issue, under the title of "A Test Indicator Used as a Comparator." This, we believe, is a new use of such a tool, and we believe it will be readily perceived by practical men that it is a thing which is likely to be of very great importance in the low cost production of duplicate work. A feature of the case which will be considered perhaps especially interesting by many of our readers is that this device and the excellent account of its use which we publish in this issue come, not from America, but from England. We believe it to be not unlikely that the time will come when every lathe grinder or similar tool will, as a matter of course, be equipped with some such device as that illustrated.

Department Stores and Parcels Posts.

Our consuls in Germany continue to send in accounts of the strenuous measures being taken to restrict the growth of department stores in Germany. Consul Harris, of Mannheim, appearing in the latest number at hand of the *Consular Reports* with an account of the very heavy taxes imposed upon such stores; manifestly with the intention of preventing their growth. He closes with the following expression: "It seems to be conceded that the special tax will have but little effect in checking the growth of these stores, and that their effect upon the smaller shopkeepers and owners of small storerooms is a somewhat grave problem."

It is curious to note how differently the growth of department stores is looked upon by certain classes of the community from the way in which the earlier growth of industrial establishments was regarded. When one looks into it a little it is readily seen that the growth of department stores is strictly analogous to the growth of large manufacturing enterprises. But when mechanics and small manufacturers complained of the growth of large manufacturing enterprises they were told that their complaints arose from ignorance; that the growth of large industrial enterprises was a necessary sequence of the development of society, and that it was very unwise for them to attempt to resist such growth. Particularly the commercial men were insistent upon this view being taken, and we agreed with them. But it now seems to make considerable difference as to whose ox is gored, and not only have the commercial men changed their tune regarding this matter, but in Germany, at least, they have evidently succeeded in securing the enactment of very severe restrictive laws designed particularly to prevent the growth of large commercial enterprises. It is a curious thing, and our belief is that in any country where the people are given to thinking it cannot be permanent.

Much the same principle is involved in some of the opposition to the proposed parcels post. Some of our trade contemporaries, and one in particular, is very strenuously opposing the parcels post and for

no discoverable reason except that such parcels post may possibly benefit the so-called catalog or mail-order houses. Now, as a matter of fact, the development of means of carrying goods between manufacturers and users is as legitimate and proper as is any improvement in manufacturing or distributing processes. It tends directly toward reducing the cost of effective production of manufactured goods and has precisely the same economic justification that an improved method of manufacture or transportation has. If a railroad company makes an improvement in transportation by which the cost of carriage is reduced, we are in the habit of considering that to be an achievement of value to mankind; and the same thing applies to improvements brought about in steamships. Now the only way these things can be of value to mankind is by reducing the cost of effective production; that is to say, by reducing the necessary cost of placing in the hands of the consumer a thing which he desires and is willing to make a fair exchange for. The parcels post proposes to do just this thing, and it has worked well and is working well in a number of European countries. The only interests that oppose it here are the express companies and those who are opposed to department stores, to mail-order houses and catalog houses, the opposition of the express companies being of course based upon the fact that they have at present a monopoly of the carriage of goods of the class which would be carried by the parcels post. We regret to see technical journals taking up the fight in behalf of these interests and against the undeniable interests of the general public. We believe that national and international parcels posts would be in the direct interests of manufacturers especially since they would greatly facilitate their dealings with customers and by reducing costs stimulate consumption.

The Age Limit vs. the Size Limit.

The Swiss are a pre-eminently commonsensical people and a rule has been adopted on their publicly owned railways which solves the difficulties arising from the attempt to charge for the transportation of children according to age. In future all children under 2 feet 1 inch in hight will be passed at half fare, and those above, whatever their ages may be, will be treated exactly as adults. At each station, near the ticket office, a measuring machine (limit gage) is to be fixed, and whenever a child applies for a half-fare ticket he will be invited to stand under the scale.

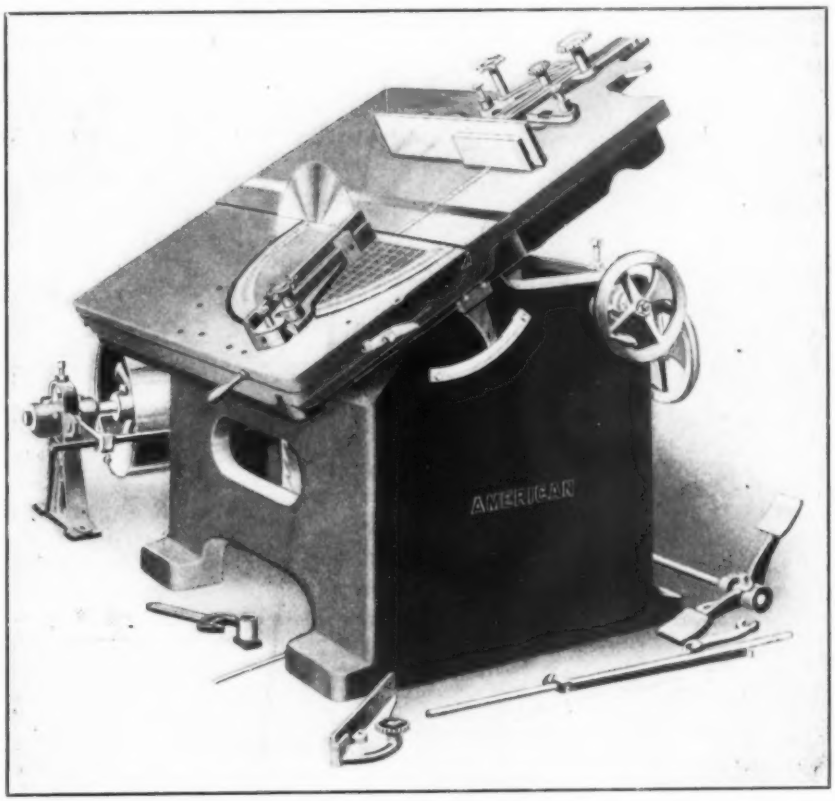
Nothing is clearer than that it costs as much to carry a child nine years old as it does to carry one thirteen years old if their hight and weight are the same, and the new plan if adopted here would prevent a lot of cheerful lying and be a great relief to conductors and ticket agents. It would also promote the wearing of spring heeled shoes, which would probably be another good thing.

New Tools and Machine Shop Appliances.

A NEW UNIVERSAL SAW TABLE.

The half-tone shows a saw table adapted to the requirements of the pattern-maker, the cabinetmaker or the general wood-worker with a wide and exacting range of work. The machine belongs to the modern family of wood-working tools, the builders of which think it, and in a business way find it, worth while to build such tools with the care and precision which have too long been assumed to be demanded only by the machinist or other accurate metal worker.

The box frame of the machine is a single rigid casting with three bearing points on the floor. The table is 45 inches long and 30 inches wide. The left-hand top of the table, guided by planed and scraped ways, moves on frictionless rollers and can be moved laterally away from the main section 2½ inches to admit dado heads or special cutters. The entire table can be tilted 45 degrees by a screw and radius arm, with an accurately graduated index in front and a stop at the rear. The arbor yoke is extra long, carrying two tool-steel arbors, 1¼ inches diameter, with long, self-oiling boxes and the pulleys between them. The yoke swings on gudgeons on both sides of the saw line; the circular adjustment is by a worm wheel with a double-pitch worm. The ripping gage takes from 0 up to 24 inches wide, and the fence tilts to 45 degrees. The entire gage also swings horizontally on one of the retaining pins for sawing out semicircular coreboxes or similar work. There is a micrometer adjustment of the gage with a range of 8 inches. The gage may be transferred to the left-hand table when desired, and there is on its face a detachable block which can be used as a cut-off stop. The cut-off or miter gage is swiveled on the rolling table section and is stopped by a taper pin at all the principal angles, with a complete half-circle protractor for any angle desired. There is added a novel cross-graduated sector, by which angles corresponding to any required dimension of work can be cut *without previously determining the angle.* The right-hand table has a rule to inches and eighths for cutting off.



A NEW UNIVERSAL SAW TABLE.

A supplementary cut-off gage is fitted to the right-hand table for long work. A special sleeve is provided for the attachment of dado heads. An idler jack is supplied, carrying two 7-inch pulleys on steel shafts with self-oiling bronze bushings. The countershaft may be located on the floor at the rear of the machine or below the floor and at a distance from the machine. The belt shifter is arranged to be operated by a pedal lever. All the adjustments in working are quickly and accurately made, so that as little time as possible is lost in changing from one operation to another. This saw table is built by the American Wood Working Machinery Company, 136 Liberty street, New York city.

ELECTRO-MAGNETIC CLUTCH.

The accompanying illustrations show an electro-magnetic clutch which is the product of the Williams Electric Machine Company, of Akron, Ohio.

The principle of the design is shown in Fig. 1, from which it will be seen that a series of Weston multiple friction disks *a* are drawn into contact by a magnetic coil *b* to which current is carried by brass slip rings *c*. One half of the disks are loosely fitted by key lugs to the loose pulley *d* and the other half to the driven member *e*, which is keyed to the shaft. The energizing of the coil draws the armature *f* toward it and hence introduces friction between the plates, the effect of the friction being multiplied by the number of surfaces in contact. The result is a very small consumption of current and a very easy breaking of the residual magnetism, this breaking being still further facilitated by the fact that between each pair of surfaces is an incipient air gap. The current used by a 15 horse-power clutch at 300 revolutions per minute is one-third of an ampere at 110 volts.

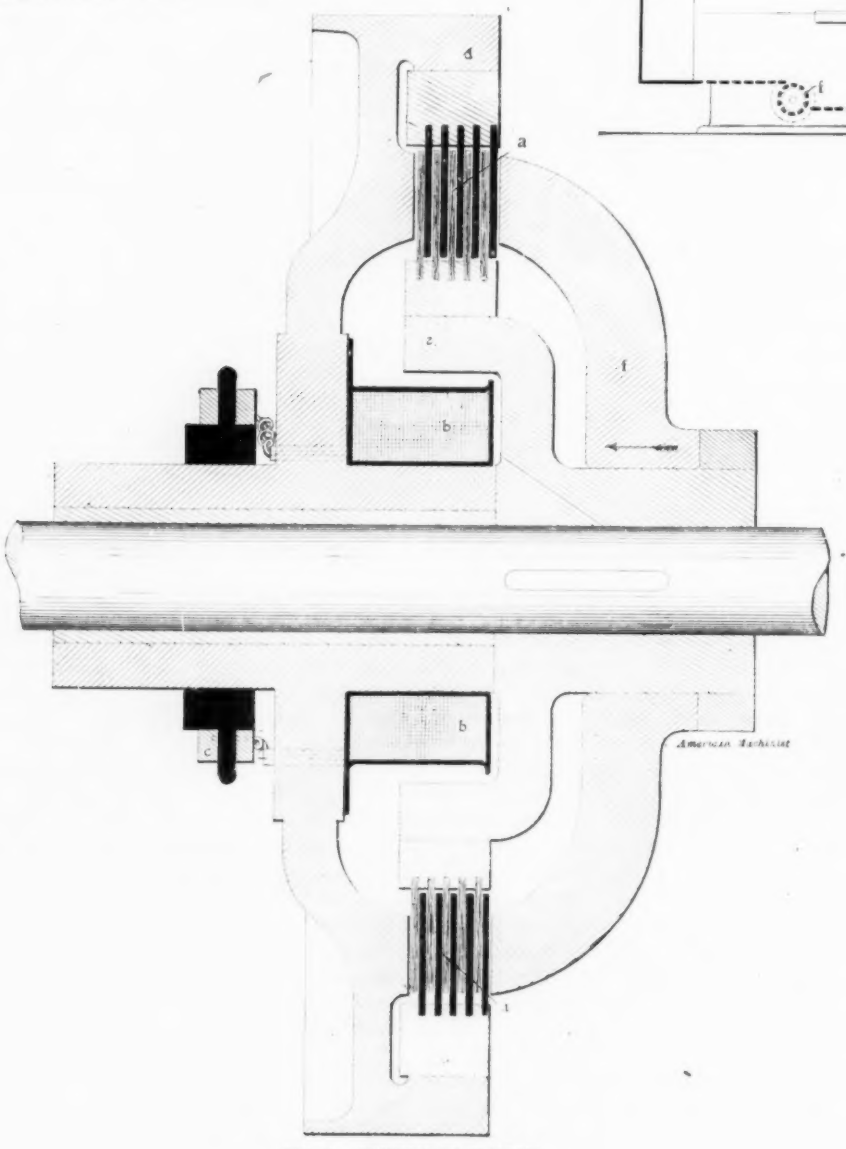


FIG. 1. SECTION OF CLUTCH.

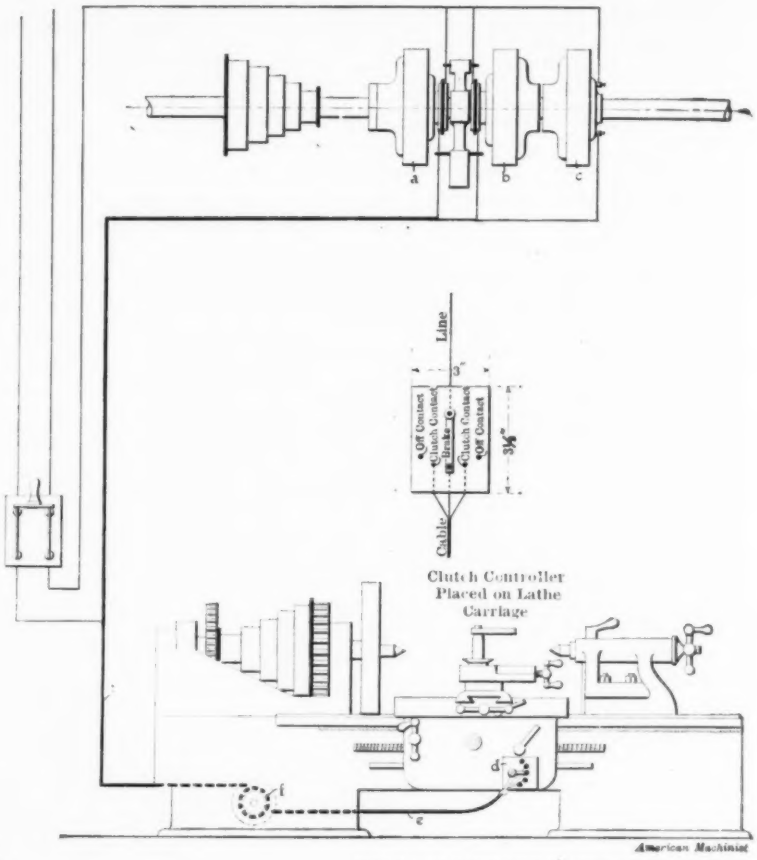


FIG. 3. CLUTCH CONNECTED TO A LATHE.

A low degree of saturation of the magnetic circuit is used at which the grip of the clutch is practically proportional to the current, so that, by increasing the current, a corresponding increase of grip is obtained. This increase of current is obtained by cutting out a resistance coil in series with the clutch. Such resistance is unnecessary except when a slow start is desired, and when supplied its manipulation involves nothing but the addition of contact points to the controller.

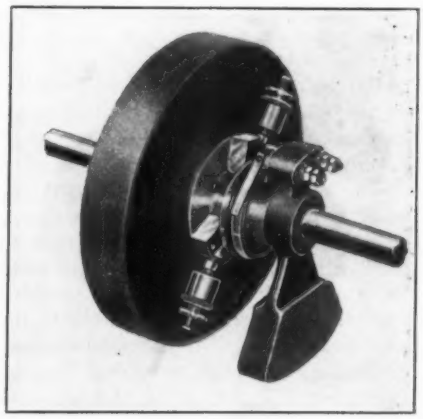


FIG. 2. CLUTCH COMPLETE.

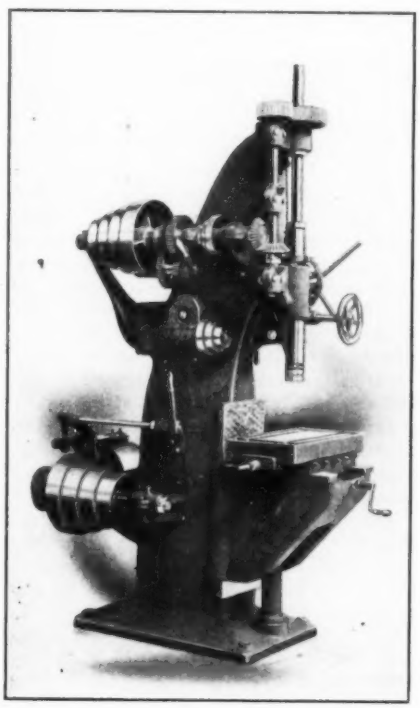
Fig. 2 shows the clutch complete and supplied with an oil-tight casing for flooded lubrication, and Fig. 3 shows it as applied to a lathe, the clutches for operating the lathe being shown at *a b* and a magnetic brake at *c*. The controlling switch is

mounted upon the apron of the lathe at *d*, and because of the small amount of current handled by it it is very small, as shown by the small dimension sketch at the right. To the contact points of the controlling switch a four-wire cable *e* connects clutches, brake and line, a slack reel being interposed at *f*. The office of the brake is not only to stop the lathe promptly, but to lock it for putting on a face-plate or chuck, or for tapping a hole or screwing on a nut. The placing of the switch lever on the brake contact locks the lathe. This contact is between the clutch contacts, and the brake is thus thrown momentarily into action whenever the lathe is reversed, thus taking up the momentum of the lathe and countershaft and preventing the consequent slipping and wear of belts.

A HIGH-SPEED DRILL.

The accompanying illustration shows a drill press designed to withstand the heavy feeds and high speeds that can be used with high-speed steel drills. These machines have a speed range from 500 to 40 revolutions per minute, being adapted to drills from ½ to 1¼ inches in diameter.

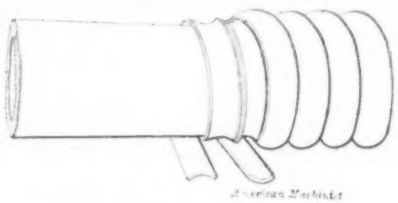
The illustration shows a machine arranged with a compound table having screw adjustments in all directions. The advantage of this type of table over the circular swinging type of table is greater than would at first appear. Where accurate work is desired the swinging table cannot be used, as it cannot be made sufficiently stiff to withstand the severe thrust. Besides, the alinement of the split clamp for the table and also the knee on the circular column cannot be satisfactorily maintained. The work, when set accurately under the drill, will draw away when the table is tightened up. All this is done away with in the compound table. The work, when clamped, can be quickly and accurately centered on the drill or reamer, and held fixed without clamping the table. By means of micrometers which are provided, spacing can also be done without the necessity of previously "laying out" the work. These machines are built by Baker Brothers, Toledo, O.



A HIGH-SPEED DRILL.

FLEXIBLE STEEL ARMORED HOSE.

A flexible hose for steam or air is one of the modern mechanical necessities, the field of its employment is a vast one and its conditions of service are exacting. It is used for rock drills and for the whole family of portable pneumatic or steam-driven tools, for air-brake service and various other purposes. It has been necessary to produce a hose still flexible but capable of carrying high pressures and of enduring all the vicissitudes of hard service and various abuse. The familiar wire-wound hose has done its best to supply the demand, but has its objectionable features, and the hose here shown would seem to be a self-evident and decided improvement. A suitable rubber hose is provided and is wound with steel strips of curved section in the manner here shown. The winding, it will be seen, is double, the first strip being wound with the convex side to the hose and a second strip being then wound over the other with the convex side outward, its concave side covering the joints of the first strip. The enclosed hose is thus held against the internal pressure, is protected most effectively outside and is as flexible as can be desired. It will not flatten or kink and will stand the highest pressures. A three-ply hose thus armored will stand a hydraulic pressure of 2,000 pounds to the square inch. Special couplings and fittings have been designed for use in connection with this hose. It is manufactured by the Sprague Electric Company, 527 West Thirty-fourth street, New York city.



FLEXIBLE STEEL ARMORED HOSE.

RIVET SPINNING MACHINE.

The machine shown in the cut is designed for spinning heads on the shanks of rivets as distinguished from forming the heads by blows of a hammer or machine. The part to be riveted is placed head down on the anvil of the machine and pressure on the foot treadle forces the rapidly rotating spindle downward and causes the spinning rolls—which are formed for the shape desired—to spin a head on the blank shank of the rivet. There is no upsetting action; shoulder rivets or rivets closely fitting holes in parts to be riveted may be headed without danger of binding the parts when a flexible joint is required, as is often the case in typewriters, adding machines and other mechanisms.

RIVET SPINNING MACHINE.

The capacity of the machine is for ¼-inch rivet shanks and smaller. The distance from the back of the throat to the center of the rolls is 4 inches, the adjustments of the anvil 1¼ inches, the width of the belt 1¼ inches; bench space required, 10 inches wide by 15 inches deep by 23 inches high. It is manufactured by the Grant Manufacturing & Machine Company, Bridgeport, Conn.

Not a Clutch Coupling.

We have a letter from T. Cooke & Sons, Ltd., Buckingham Works, York, England, referring to the article we published at page 92, and in respect to which they say: "The first paragraph is almost wholly incorrect and misleading. The coupling was *not* 'designed to be put out of gear periodically,' nor was it intended 'to combine the functions of clutch and coupling,' for *this it will not do*. Your contributor has dropped into a hole by imagining that the outside ring grooves on the boss of each coupling were intended to take lever jaws for the purpose of sliding the couplings along their shafts, whereas each coupling bears against the side of a pedestal, and the grooves were cut in to prevent oil from the pedestal from traveling along the boss and being thrown off into the workshop. This they do well. So far from the coupling being necessitated by the peculiar idea of some millwright, it has proved a satisfactory solution of what was only a simple problem."

The coupling referred to was made and is in use in the works referred to, and the information given above is therefore authentic.

New Publications.

"Gas and Oil Engine Managemnet." By M. P. Bale. 110 5x7-inch pages. J. B. Lippincott Company, Philadelphia; Crosby, Lockwood & Sons, London.

This book is intended for and will be found very useful by those who have to operate gas and oil engines. It discusses at length failures and defects of such engines, taking up the valves, ignition, piston rings, vaporizers, etc., and discusses their action and the causes of their failures.

Graphite, for April, published by the Joseph Dixon Crucible Company, Jersey City, N. J., is a very attractive number. Its twenty-four pages, standard size (the same as our own) contain a great many fine half-tones of some of the prominent buildings in New York and the other large cities, with railroad and other structures where the Dixon graphite paints have been successfully used. It is sent to all who ask for it.

"Die Steuerungen der Dampfmaschinen." By Carl Leist. Professor in the Royal Technical High School at Berlin. Second, greatly enlarged and revised, edition. 939 6¼x9-inch pages. 553 illustrations. Berlin: Julius Springer.

This book on valve gears is a characteristic product of Teutonic industry in authorship. Its present edition, which is the second prepared by Prof. Leist, is rated also as the fifth of the treatise of the same title by Emil Blaha, to which it is, in some respects, a successor, altho really an independent work.

"Ferric and Heliographic Processes." By Geo. E. Brown. 149 5x7¼-inch pages with 20 illustrations. Tennant & Ward, New York. Price $1.

This is a *résumé* of the leading sun printing methods of copying tracings which have now become so universal, and of which the blueprint process, by reason of its simplicity, still holds supremacy. The explanation of all of the processes is full, explicit and practical, illustrations of the apparatus necessary being included. A feature of the book is a sample print made by each of the leading processes, by which those who use the processes may judge of the goodness of their results. The book will be found very useful to all who desire to experiment with or to make use of processes with which they are not already familiar. Those who are sufficiently acquainted with chemistry to be able to understand the chemical reactions of the various processes will find them duly explained, altho those who are not familiar with chemistry will find the explanations so clear and explicit that they may be readily followed without such knowledge.

Personal.

H. J. Barron is now connected with the Green Fuel Economizer Company, Matteawan, N. Y., and will be located at the New York office of the company, 74 Cortlandt street.

Obituary.

James W. Walter, senior member of the firm of Walter Brothers, machinists, Veedersburg, Ind., died March 20.

Alonzo Johnson died at Springfield, Mass., March 23, seventy-seven years old. Mr. Johnson was born at Bangor, Me., and learned the machinist trade at Canton, Mass. During the Civil War he was working at the Springfield Arsenal, but soon after went into business for himself. In his shop many inventors had their ideas developed, especially in automobile and motor-cycle lines. Mr. Johnson's specialty was the envelope machine now used extensively by the United States Envelope Company.

The Eastman Kodak Company, of Rochester, N. Y., is about to equip this summer several new factories in the United States and Canada and is preparing, at the Kodak Park works in Rochester, for the manufacture of the special tools and machines necessary.

It is gratifying to note the action of the United States Steel Corporation in recently advancing the rates of wages of its employees to the extent of $9,000,000 on its annual payroll. In a sense this is not an advance but rather a restoration of the normal rates of busy times. It is therefore in a way an assurance to the mechanical world at large from the concern perhaps the best informed, as also the most largely interested in our industrial future, that all businesses are to be profitably active for a long period ahead, and that all are to be calling for its various fabrications of iron and steel. The officials and employees of the great corporation are all to be congratulated upon this natural and proper act, and many other concerns might well take it as an example of the best way of doing what perhaps may later become the imperative thing.

The largest double-throw crankshaft in the world was recently forged under the 4,000-ton hydraulic press of the Bethlehem Steel Company, South Bethlehem, Pa. The shaft is one of three ordered by the International Steam Pump Company. It will be when finished 27 feet long. The largest pin diameter is 37 inches. The webs in extreme dimensions will be 64x49 inches and 16⅜ inches thick. The weight of the ingot was 240,000 pounds.

April 5 at the rooms of the Engineers' Club of St. Louis, 3817 Olive street, E. G. Helm will lecture on "The Levee and Drainage Problem of the American Bottoms."

April 1 at 8.15 P. M., L. F. Rondinella will present a paper entitled "The Reproduction of Drawings of Great Length and Number" before the Franklin Institute, of Philadelphia.

Business Items.

The Massey Machine Company, Watertown, N. Y. builder of machine tools, has recently acquired entire control of the ring turret lathe. The facilities of its plant are being steadily increased to meet the growing demands for this lathe.

Ezra Sawyer, of Worcester, Mass., has retired from the business of making metal separators and sold his interest to Chas. T. Burlin, of Whitinsville, Mass. Mr. Burlin has been associated with Mr. Sawyer in his magnetic separator business for a number of years and will run the business under his name at Whitinsville.

The relatively small, but very complete forge shop equipment recently installed by the B. F. Sturtevant Company, of Boston, Mass., for the Enterprise Manufacturing Company, of Philadelphia, is typical of the advance in forge shop methods. The blast is furnished by an electrically driven fan arranged for suspension from the ceiling, where it will occupy no valuable space. A special electric exhaust fan positively draws away all smoke and gases from the fires, with the result that the room is kept clear and fresh as any other part of a manufacturing plant.

The variety of conditions which may be controlled by the modern blower system of heating and ventilation is very well illustrated in the recent installation made by the B. F. Sturtevant Company, of Boston, Mass., for the New Freedom Company, New Freedom, Pa. The buildings comprise a drying room requiring relatively rapid circulation, a loom mill for which a moderate supply of fresh air is essential, and an office where the maximum of comfort is demanded. The total contents are nearly 400,000 cubic feet. The apparatus is so located as to draw fresh air thru a heater and force it in such proportionate amounts to the various apartments as to maintain in each case the requisite temperature.

Manufacturers.

The Niles (O.) Fire Brick Company will erect a new plant.

The Cleveland (O.) Oil Soap Company will erect a new factory.

The Leominster (Mass.) Comb Company will erect a new shop.

The Keifer Mold Company, of Gas City, Ind., will move to Alexandria, Ind.

The Foster-Adams Company, Utica, N. Y., will erect a new paper-board factory.

The citizens of Hopkinsville, Ky., have subscribed $15,000 for a canning factory.

The Monmouth Canning Company, Portland, Me., will erect a factory at Gorham.

Lewis F. Fales, Walpole, Mass., is about to build a large addition to his machine shop.

The Goldens Foundry & Machine Company, Columbus, Ga., is putting up a new foundry.

The American Pulley Company, Philadelphia, Pa., will erect an addition to its plant.

The Potter & Johnston Company, Pawtucket, R. I., is having two additions to its plant built.

The Albany (Ga.) Phosphate Company has been organized and will build a $200,000 plant.

The Story & Clark Piano Company, Grand Haven, Mich., will put up a new factory shortly.

The Butler Foundry & Iron Company, Chicago, Ill., has been granted a permit to erect a factory.

A new wagon factory will probably be built in Paducah, Ky. T. C. Leech, of that place, is interested.

The National Phonograph Company, New

York, will erect a large factory in West Orange, N. J.

The American Magnesite Company, San Francisco, Cal., will erect three plants in East Oakland.

The American Conduit Company, recently organized, will erect a $30,000 plant at Auburndale, O.

The removal of the boiler factory of Broderick & Quinlan from Montpelier to Muncie, Ind., is reported.

The Johannigman Foundry Company, Cincinnati, O., will erect a $35,000 foundry in Cumminsville, O.

The Hart-Parr Company, Charles City, Iowa, will double the capacity of its gasoline engine plant.

Joseph Simpson & Son, Toronto, Ont., operating a knitting mill, will erect a power-house and reservoir.

The Red Wing (Minn.) Boat Manufacturing Company has decided to erect a new factory, to cost $15,000.

The United States Gypsum Company, Chicago, Ill., has let contracts for the construction of its new plant.

It is reported that a large woolen mill will be erected in Reno, Nev. P. L. Flanigan, of that city, is interested.

The Louisville & Nashville Railway Company will build car shops in the Burnside yards, Knoxville, Tenn.

The American Malting Company, Buffalo, N. Y., will erect an elevator and malting plant, to cost $1,000,000.

H. B. Camp, of Akron, O., is preparing to erect a plant at Independence, O., for the manufacture of sewer pipe.

The Kingston Manufacturing Company, of Little Falls, N. Y., will establish a last factory in Franklinville, N. Y.

The Eagle Lock Company, Terryville, Conn., has bought more land, and it is thought a new building will be erected.

The M. F. Lieberman Sheet Metal & Roofing Company, Economy, Pa., is erecting a factory building, to cost $12,000.

B. Frank Meiane and Arthur Draper, Spray, N. C., it is reported, have arranged to erect a $1,000,000 denim mill.

The Consolidated Gas, Electric Light & Power Company, Baltimore, Md., will erect a power-house at Westport, Md.

The American Dyewood Extract Company, of Philadelphia, is making extensive additions to its plant at Chester, Pa.

William B. Cochran, Paterson, N. J., jacquard cutter, is contemplating the erection of an up-to-date mill structure.

The Greendale Gas Engine Company, Worcester, Mass., is erecting a new building, and will require some new machines.

The Vermont Spool & Bobbin Company will remove from Essex Junction to Burlington, Vt., where a new plant will be built.

A brass foundry will be erected in Hoboken, N. J., for Henry Moeller, now in business at 65 Carlton avenue, Jersey City.

The E. K. Wood Lumber Company, Hoquiam, Wash., is erecting a new dry kiln, new sheds and additional boiler capacity.

A stock company has been practically organized for the erection of a pump factory by Andrew Miles, of West Duluth, Minn., and others.

Joseph Iswert, of Pinckneyville, Ill., and others have bought land in Armourdale, Kan., on which a $200,000 flour mill will be erected.

C. H. Urick, Erie, Pa., and his sons are forming a company and have invited bids for the erection of a new jobbing foundry, to cost $25,000.

The William Cramp Ship & Engine Building Company, Philadelphia, Pa., has been granted a permit to build a shop, to cost $10,000.

The Southern Skein & Foundry Company, Chattanooga, Tenn., recently organized, has commenced the erection of a plant, to cost $50,000.

The Morgan Silver Plate Company, Winsted, Conn., will shortly erect a factory addition, in which a 50 horse-power boiler will be installed.

Plans for a proposed factory for the Lauter Company, piano manufacturers, Newark, N. J., are being drawn by Hurd & Sutter, of that place.

The Wabash Railroad Company will erect shops at Decatur, Ill., the citizens of that place having donated land and $200,000 for the purpose.

Cramp & Co., Philadelphia, Pa., have posted plans for a large powder manufacturing plant for the United States Government, near Dover, N. J.

The F. W. Bird Company, of East Walpole, Mass., manufacturer of paper boxes, roofing paper, etc., will shortly erect a factory at Hamilton, Ont.

It is reported that the Bethelehem Company will make additions to the Harlan & Hollingsworth plant at Wilmington, Del., which it controls.

The paint shop of the St. Louis, Iron Mountain & Southern Railroad at Baring Cross, Little Rock, Ark., was burned; loss, $65,000. It will be rebuilt.

Beaton & Corbin, manufacturing ceiling and floor plates and steam fitters' specialties, are building a new addition to their factory at Southington, Conn.

Barrett, Denton & Lynn, Dalton, Ga., will erect a new flouring mill. A 200 horse-power engine will be installed, as well as new and improved machinery.

The Bonner Manufacturing Company, Chrisman, Ill., will erect an addition to its wrench factory. It is said $50,000 worth of machinery will be installed.

The City Dye Works & Laundry Company, Los Angeles, Cal., will erect a new plant, which, it is said, will be the largest of its kind on the Pacific Coast.

The South Sharon (Pa.) plant of the American Tin Plate Company is to be enlarged. Plans have been drawn for large additions to the finishing department.

The New Home Sewing Machine Company has completed arrangements for a new factory at Orange, Mass. Chester N. Tyler, of that place has the contract.

The Mount Washington (Md.) Electric Light & Power Company is having plans prepared for a large power-house by Architect Thos. C. Kennedy, Baltimore.

It is reported that the Spencer Mountain Mills, Lowell, N. C., will build an additional mill, as engineers have been engaged for proposed water-power development.

Announcement is made that the United States Steel Corporation will make additions and improvements to the Duquesne plant at an expenditure of about $5,000,000.

The Middlefield (O.) Manufacturing Company has been incorporated. This company will manufacture an improved hot air engine invented by F. B. Hubbard, of Warren.

The Commercial Club, of Independence, Kan., is making arrangements for the rebuilding of the Western Window Glass Company's plant, which burned some time ago.

The American Dressed Beef Company has closed a deal with the Fort Scott (Kan.) Commercial Club, in which they agree to erect a $200,000 packing plant at that place.

The D. C. Prescott Company, Marinette, Wis., is reorganizing. The capital will be increased to $500,000 and the plant doubled, so as to permit the inclusion of a steel works.

The Billings (Mont.) Sugar Company has been incorporated with a capital of $750,000. J. F. Kilbey, of Kilbey Manufacturing Company, Cleveland, O., will outline the work for the plant.

The Wheeler Foundry Company, Worcester, Mass., has been incorporated with a capital of $50,000. William B. Pierce, whose foundry business the new company has purchased, is president.

The Nashville Carbon & Oil Company, recently incorporated with a capital of $500,000, has opened offices in the Cole Building, Nashville, Tenn., and proposes shortly to build a plant.

It is reported that a sash and door factory will be established in connection with the Estacada (Ore.) Wood Manufacturing Company. Otto Helfricht, of Portland, Ore., is negotiating the deal.

Plans have been completed for a factory office and foundry building for the Aldine Grate & Mantel Company at Grand Rapids, Mich. W. G. and F. S. Robinson, of that place, are the architects.

The Hood Rubber Company, Watertown, Mass., will make large additions to its plant, some time in the future erect two more buildings, one to be used for wood working and the other as a foundry.

The American Wood-Fibre Company, capitalized at $25,000, will erect a plant in Birmingham, Ala. This will be a branch of a company in Akron, the original company being capitalized at $100,000.

The Westinghouse Manufacturing Company will erect a branch factory in Attica, N. Y., which will employ 200 hands. The construction work will be in charge of Westinghouse, Church, Kerr & Co., New York.

The Mexican Aluminum Company, of Mexico City, Mexico, proposes to erect a plant to manufacture finished articles in aluminum, and has petitioned the government to allow the importation of the necessary machinery free of duty. The factory will cost $200,000.

Plans have been about completed for an addition to the Huntington Piano Factory, Shelton, Conn., owned by the Blake Corporation, of Derby. A freight elevator will be installed, also a 10,000-gallon tank and sprinkler system.

George H. Cutting & Co., Contractors, of Milford and Worcester, Mass., have been awarded the contract to build an addition to the Dexter Richards & Sons Woolen Mill Company's plant at Newport, N. H., which will cost over $80,000.

Albert L. Schultz, former head of the Schultz Bridge Company and later manager of the Pittsburg works of the American Bridge Company, is at the head of a movement to build and operate a large independent bridge works at Buffalo. It is said the new plant will be built this year and empoy 2,000 men. Mr. Schultz is well known in Youngstown, O.

New Catalogs.

Allentown Rolling Mills, Allentown, Pa. Pump data, No. 8. This is descriptive of ground plunger pumps.

Globe Iron Works, Stockton, Cal. Catalog of Truax automatic ore cars. Illustrated. 6¼x9½, pp. 28, paper.

Scully Steel & Iron Company, Chicago, Ill. March and April, 1905, Stock List. Illustrated. 4½x7, pp. 144, paper.

Atlas Machine Company, Providence, R. I. Circulars and price lists of Atlas toolmaker's vise and extractor of broken taps.

The Washburn Shops, Worcester, Mass.

Catalog "C" of drill grinders. This contains illustrations and price lists. 6x9, pp. 22, paper.

Ridgway Belt Conveyor Company, 29 Broadway, New York. Circular describing the Ridgway two-belt conveyor system. Illustrated.

Lincoln-Williams Twist Drill Company, Taunton, Mass. Circular containing description and tables of high-speed twist drills. Illustrated.

The Buda Foundry & Manufacturing Company, Railway Exchange Building, Chicago, Ill. Bulletin No. 11, describing Buda metals. 6x9, pp. 8, paper.

The Fred. J. Swaine Company, St. Louis, Mo. Booklet referring to power, screw, drop and foot presses and dies. Illustrated. 3½x6, pp. 8, paper.

I. B. Williams & Sons, Dover, N. H. Booklet, entitled "What a Belt Should Do," containing useful information for belt users. 3½x6, pp. 12, paper.

Corrugated Grinding Wheel Company, Philadelphia, Pa. Pamphlet describing a new grinding wheel. Illustrated. 3½x6¼, pp. 6, paper.

The Wellman-Seaver-Morgan Company, Cleveland, O. Circular describing the Johnson patent arch plate. Illustrated. 6x9, pp. 4, paper.

Comstock Engine Company, 49-61 Clymer street, Brooklyn, N. Y. Booklet describing lubricator for using oil and graphite in combination. Illustrated. 3½x6½, pp. 7, paper.

The Goldschmidt Thermit Company, 43 Exchange Place, New York. Pamphlet on the repairing of roll bosses by means of Thermit. Contains illustrations and testimonials. 5x 8½, pp. 8, paper.

H. B. Underwood & Co., 1025 Hamilton street, Philadelphia, Pa. 1905 catalog of special tools for repair shops. This contains half-tone illustrations, tables and telegraphic code. 6x9, pp. 36, paper.

Peter A. Frasse & Co., 92-94 Fulton street, New York. Price list and description of "Poldi" superior tool steels, containing some points about working steel and various tables. Illustrated. 4½x6½, pp. 36, paper.

Allis-Chalmers Company, Milwaukee, Wis. Catalog No. 119, describing cement-making machinery, including rock breakers, crushers, dryers, kilns, ball mills, tube mills, elevators and conveyors. Illustrated. 8x10½, pp. 44, paper.

Ulmer Leather Company, Norwich, Conn. Catalog describing the different kinds of belts made by this company, also belt dressing and cement. Has some information about belting and rules for figuring speed of pulleys, etc. 3½x6, pp. 12, paper.

Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. Folder No. 4038, illustrating and describing type "F" induction motors. 3½x6, pp. 8, paper. Folder No. 4039, illustrating and describing type "R" direct-current motors. 3½x6, pp. 8, paper.

The Kempsmith Manufacturing Company, Milwaukee, Wis. Catalog describing the various milling machines and attachments made by this company. This is handsomely executed, contains half-tone illustrations and is printed on fine coated paper, 9x11, pp. 23, paper.

The E. J. Manville Machine Company, Waterbury, Conn. Supplement to Catalog "A," 1904, describing automatic "four-slide" wire forming machinery. Illustrated. 6x9, pp. 7, paper. Catalog "C," 1905, of rivet machinery and screw-blank headers. Illustrated. 6x9, pp. 11, paper. Catalog "D," 1905, describing screw thread-rolling machinery and screw slotters. Illustrated. 6x9, pp. 7, paper.

Mesta Machine Company Pittsburg, Pa. Catalog B, December, 1904. This is a very handsome catalog, describing and illustrating by excellent half-tone engravings the works and some of the machinery built by the company, including Corliss and piston-valve engines for rolling mills, blast furnaces and power plants, rolling mill machinery, machine-molded gears. It is of standard size, 9x12, printed on fine coated paper, contains 127 pages and bound in cloth.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Punches & dies. Wal.M.Wks., Waltham, Mass.

Light drop forgings to order in quantities. Remington Arms Company, Ilion, N. Y.

Light mach'y to order; model work; rubber molds. J. W. Weir, Bridgeport, Conn.

Will buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Automatic machinery designed and constructed by the Wellman Sole Cutting Machine Co., Medford, Mass.

The "Mechanics' Pocket Manual" for industrious people is a wonder of the age. Price $2, post paid. E. S. Boynton, 200 W. Brighton ave., Syracuse, N. Y.

Dies, jigs and fixtures; tools designed for special work; manufacturer of clockwork specialties and intricate mechanical instruments. D. S. Plumb, 57 E. Park st., Newark, N. J.

Wanted—Vicinity of New York City—To buy or lease small machine shop (about 12 men capacity), suitable for die and model work. Address Box 461, AMER. MACHINIST.

Up-to-date plant, equipped for manufacture of medium size machinery, will take contract for automatic or interchangeable machinery on which careful work is desired. Box 396, AMERICAN MACHINIST.

A Continental firm of machine tool importers, having large showroom in Paris, excellent connection and staff of travelers, require sole agency for first-class make of upright drilling machines up to 42 in. size, for France, Belgium and Switzerland. Reply Box 462, AMERICAN MACHINIST.

Modern foundry and machine shop, fully equipped for light and medium heavy work, wishes to manufacture engines, machines or machine parts; would undertake sale if desired; castings made in malleable, gray, brass, bronze and aluminum. Trenton Malleable Iron Co., Trenton, N. J., and 26 Cortlandt st., New York.

Business Opportunities.

Wanted—Partner, with good moral and business character, to invest $1,000 or upward; purpose to enlarge present business and take up new lines, both wood and metal; may include motor boats and engines; location, Trenton, N. J. Address T. P. W., care AMERICAN MACHINIST.

For Sale.

For Sale—Long-established machine shop in this thriving city; cause of sale, death in firm. W. D. Judson, New Haven, Conn.

Machine shop for sale, with right to manufacture a good invention; all new tools; a fine opening for a good machinist. Box 482, AMERICAN MACHINIST.

For Sale or for Rent—Thoroughly equipped modern machine shop, in good locality; excellent opportunity for anyone with money to get into a good business immediately. Box 459, AMERICAN MACHINIST.

I can sell your machine shop (or other business), with or without real estate, no matter where it is or what it is worth. Send description, state price and learn how. W. M. Ostrander, 111 North American Bldg., Philadelphia.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents. Only bona-fide situation want or help want advertisements inserted under this heading. Agency advertisements must be placed under Miscellaneous Wants.

Situations Wanted.

Classification indicates present address of advertiser, nothing else.

CONNECTICUT.

Master mechanic or foreman, position by expert machinist tool and die maker on sheet metal and wire goods; good draftsman; cost reduced through combination dies. Box 469, AMERICAN MACHINIST.

DISTRICT OF COLUMBIA.

Draftsman, experienced, seeks position. Box 470, AMERICAN MACHINIST.

MASSACHUSETTS.

Mechanical draftsman wishes position. Address Box 476, AMERICAN MACHINIST.

MICHIGAN.

Superintendent—At liberty May 1; age 39; educated; systematic; good manager; familiar with brass and iron foundry work; inventor of jigs and time-saving operations. Box 465, AMERICAN MACHINIST.

NEW JERSEY.

Foreman patternmaker desires position; is also draftsman; A1 reference. Box 427, AMERICAN MACHINIST.

Position wanted by first-class American mechanic with inventive ability; 12 years' experience; would like position with party working on experimental work or jobbing. Box 464, AMERICAN MACHINIST.

Position as all-around machinist in general repair shop, with chance for advancement; have varied experience, heavy and light, on machine tools, high-speed engines and sawmill machinery; 12 years' experience; also had charge; will take charge if desired. Box 458, AMERICAN MACHINIST.

NEW YORK.

Experienced mechanical draftsman wants position. Box 478, AMERICAN MACHINIST.

Mechanical draftsman (technical graduate) desires position; salary $18. Box 473, AMERICAN MACHINIST.

Mechanical engineer, with experience on gas and steam engines, desires position. Box 484, AMERICAN MACHINIST.

Draftsman; experience general, special machinery; New York or New Jersey preferred. Box 485, AMERICAN MACHINIST.

Mechanical superintendent desires position; capable of systematizing factory and reducing costs. Address Box 474, AM. M.

Superintendent or general foreman in machine shop; practical man; good executive; A1 tool designer; manufacturing or jobbing. Box 466, AMERICAN MACHINIST.

Wanted—Position (West preferred) by draftsman and designer of automatic and other machines; best of experience. Address Box 479, AMERICAN MACHINIST.

Machinist, tool, die and jig maker, 3 years foreman, age 29, would engage with growing concern where industry with experience is wanted. Box 468, AMERICAN MACHINIST.

Engineer and designer, 9 years' experience, wishes position in charge of engineering department; cranes, coal and ore handling machinery, structural work. Box 477, AMERICAN MACHINIST.

Electrical engineer, German, university graduate, with 10 years' experience in the design and construction of large and small electrical machines; desires position. Box 483, AMERICAN MACHINIST.

Foreman for manufacturing plant, experienced on all classes of tools and labor-saving machinery, mechanical draftsman, at present holding similar position, desires change. Box 472, AMERICAN MACHINIST.

American, English and German experience; expert on interchangeable manufacture, gauges, jigs, fixtures; systematizer, designer and draftsman; superintendent or other position. Box 467, AMERICAN MACHINIST.

Wanted—Position by toolmaker and machinist; 14 years' experience, 8 as foreman; familiar with gas and steam engine construction; also foundry man desires position; 25 years' experience with gray iron and brass; has handled molding machines; A1 references. Address P. O. Box 350, Union Springs, N. Y.

PENNSYLVANIA.

Draftsman, with 9 years at steam and gas engines, pumps, hydraulic and general machinery, wants situation. Box 475, AM. M.